AIR ENGINEERING

AUGUST, 1961
VOL. 3, NO. 8

AIR QUALITY CONTROL . . . FOR COMFORT, PROCESS AND PROFIT

- Controlling Temperature, Pressure, Humidity In Super-Clean Areas p. 20
- Negative Ions . . . Their Place In Indoor Comfort p. 30
- Techniques Of Low Level Air Distribution p. 32
- New Type Pneumatic Classifier Ends Dust Problem p. 19

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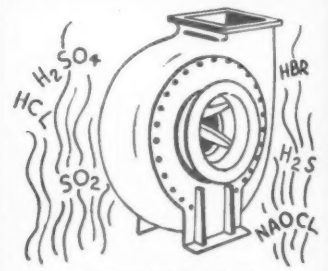
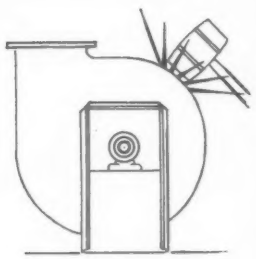
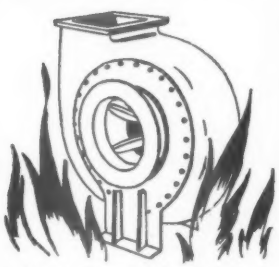
CORROSIVE FUMES MOVED with 'BUFFALO' Fiberglass Fans



Corrosion-Resistant


Impact-Resistant


Won't Support Combustion

Handle acids, salts, gases, organic materials and other corrosives in your venting systems without need for regular fan replacement. 'Buffalo' Type FG Fans in special resins withstand temperatures to 300° F. No metal parts exposed to corrosives. Flanged inlet and outlet for gas-tight connections. Capacities to 34,000 cfm, pressures to 10″ static. Contact your resident 'Buffalo' Engineering Representative or write for Bulletin FI-511 which gives complete details including chemical resistance table.

"Buffalo"

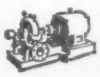
AIR HANDLING DIVISION

BUFFALO FORGE COMPANY

Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.


'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

[For more information circle #11 on page 35 reply cards]

AIR ENGINEERING

VOL. 3, NO. 8

AUGUST, 1961

AIR QUALITY CONTROL . . . FOR COMFORT, PROCESS, PROFIT

FEATURES

New Type Inertial Classifier Pays For Itself 19

High efficiency pneumatic classifier saves enough phosphate fines to pay for itself in a year, plus ends air pollution problem.

How To Control Temperature . . . Pressure . . . Humidity . . . In Super-Clean Areas 20

by C. E. Schwab, application engineer, Barber-Colman Co., Rockford, Illinois. Selection and use of controls for precise degree of thermal environment in contamination control areas.

How Beverage Bottlers Use Air Conditioning To Aid Sales 24

by John Shaw, Coca Cola Co. Outside dust and inside severe conditions of heat and humidity pose problems that would also apply to milk bottlers, pharmaceutical packaging lines and other similar industrial operations. Article gives answers.

Industrial Heat Exposure And Control 27

by Robert Lemke, mechanical engineer. Second part of a series outlining sources of heat in industry, how to calculate and alleviate its effect.

Negative Ions . . . Their Place In Indoor Comfort 30

by Lloyd Staebler and F. P. Speicher, both of Philco Corp. All about health effects of negative air ions, how air engineers can apply ionizers to conditioned spaces.

Techniques Of Low Level Air Distribution 32

by C. F. Mowrey, consulting engineer. Getting the right amount of air at the right temperature and velocity for comfort in industrial applications can be a tough design problem. Author tells how.

DEPARTMENTS

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New Products 38
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COVER

The theme of controls is shown on the front cover by artwork kindly furnished by Controls Company Of America, Schiller Park, Illinois.

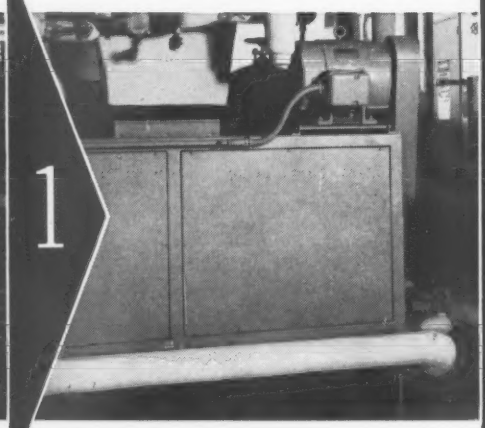
AIR ENGINEERING is published monthly by Business News Publishing Company, at 450 West Fort Street, Detroit 26, Michigan. Subscription prices: United States, Canada: $3.00—1 year; $4.50—2 years; $6.00—3 years. Foreign: $5.00—1 year; $8.50—2 years; $12.00—3 years. Single copies 50 cents. Second-class postage paid at Detroit, Michigan. First issue April, 1959. • CHANGE OF ADDRESS. Notify AIR ENGINEERING and your local Post Office of both your old and new addresses including postal zone numbers by 12th of preceding month.

• CONTENTS COPYRIGHT 1961 by Business News Publishing Company. Reproduction of material may not be made without written permission of the publisher.

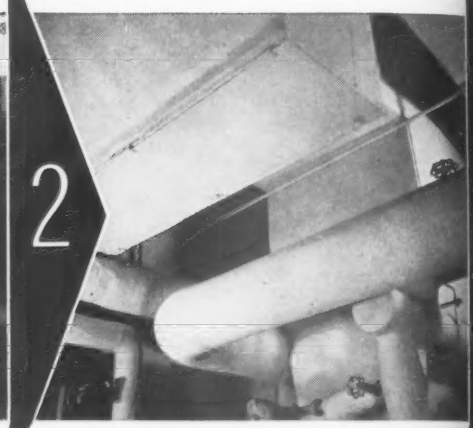
AAF keeps white-roomi

3-step air system demonstrates AAF's capability for complete air engineering

AIR FROM C. P. CLARE GENERAL OFFICE (already cleaned by AAF Electro-Matic precipitator) is cleaned again by AAF Electro-PL filters before it enters the air conditioning unit serving the white room.



AAF KENNARD/NELSON HIGH-PRESSURE AIR CONDITIONING UNIT controls white room humidity and maintains a temperature of 72° at all times. (To offset heat from manufacturing processes, the air is changed completely every three minutes.)



AIR ACTUALLY ENTERING WHITE ROOM is filtered by AAF high-efficiency Type F filters enclosed in the duct running from the outlet of the air conditioning unit to the white room.

White room operations involving the assembly of electrical relays demand ultra-clean air and rigidly controlled temperature and humidity. The planners of the new addition at C. P. Clare Co., Chicago, determined that their white room should have a complete air system all its own. Logically, they turned to AAF.

Result: white-room air to white-room standards —99.97% dust-free, constant 72° temperature and accurately controlled humidity.

AAF is the one company that provides all the major components for completely conditioned air. And, just as important, AAF offers the knowledge and experience to coordinate their functioning into one custom-engineered system.

Booklet 518 describes the complete line of American Air Filter component products. If you would like a free copy, address Richard W. Smith, American Air Filter Company, Inc., 443 Central Avenue, Louisville, Kentucky. In Canada, address: American Air Filter of Canada, Ltd., 400 Stinson Blvd., Montreal 9, Quebec.

AAF **American Air Filter**

BETTER AIR IS OUR BUSINESS

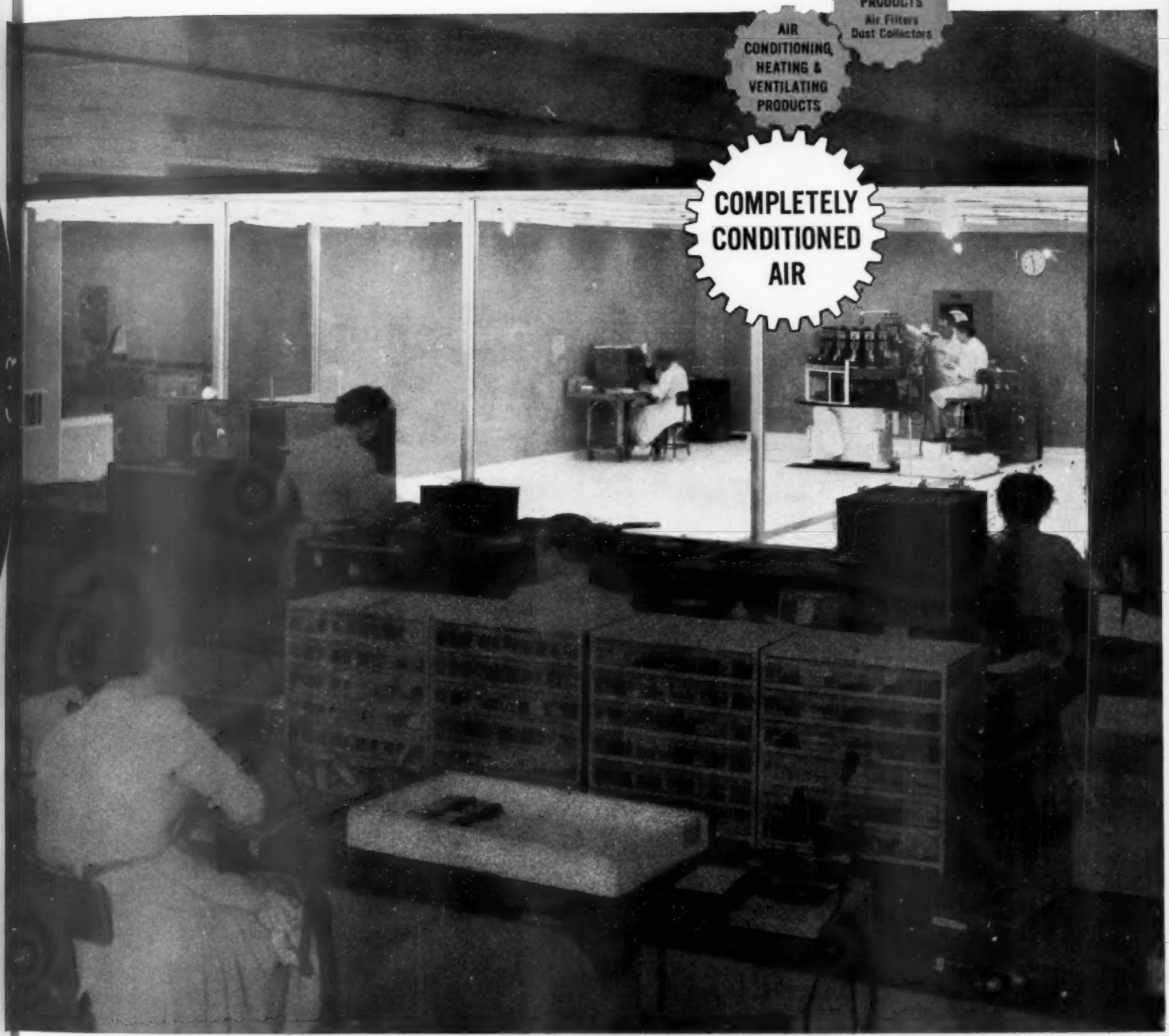
ir "*in the pink*"!

AAF

AIR CLEANING PRODUCTS
Air Filters
Dust Collectors

AIR CONDITIONING, HEATING & VENTILATING PRODUCTS

COMPLETELY CONDITIONED AIR



Architects: Rapp & Rapp, Chicago; Consulting Engineers: J. P. Bazzoni & Co., Chicago.

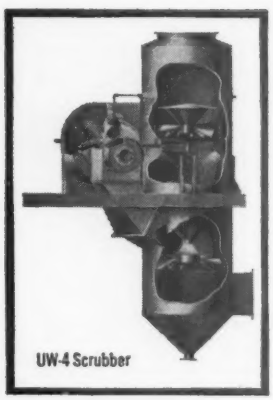
AAF products for complete air engineering

AIR CLEANING: (Atmospheric Dust) *AAF electronic air cleaners,* automatic air filters, *unit filters,* engine & compressor filters. (Process Dust) electrostatic precipitators, wet-type collectors, dry-type collectors, fabric arresters. AIR CONDITIONING, HEATING & VENTILATING: Herman Nelson air conditioning unit ventilators, unit ventilators, portable heaters; Kennard/Nelson dual-duct air conditioning units, multi-zone air conditioning units, *packaged central station air handling units,* sprayed-coil dehumidifiers, fan-coil units, packaged liquid chillers, cooling towers, evaporative condensers, direct-expansion coils, water coils, steam coils, unit blowers, industrial exhausters, centrifugal fans, unit heaters, radiation products; Illinois traps, valves, specialties, heating systems and controls.

● *Italics denote products used in C. P. Clare white room.*

[For more information circle #14 on page 35 reply cards]

THE SWIRL, SWAT AND SCRUB METHOD OF CONTROLLING DUST



UW-4 Scrubber

There's an old song that goes something like this: "It Ain't What You Do; It's The Way That You Do It." This holds true for wet dust collection and one of the most effective ways of **doing** it is dynamically with a Ducon UW-4 Scrubber.

The centrifugal forces and water action inside this scrubber, combining with the unique and effective dynamic action of the high velocity fan in the second stage of operation, literally swirl, swat and scrub all the dust particles from the gas stream.

The UW-4 Scrubber is a most effective unit for separation of extremely fine dusts and abrasive materials and is ideally suited for heavy dust loads and high temperature applications.

Send for Bulletin 7460.

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THE **Ducon** COMPANY, Inc.

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Canadian Branch:

THE DUCON COMPANY, of CANADA, Ltd., 1121 Petit St., BURLINGTON, ONTARIO, CANADA

[For more information circle #15 on page 35 reply cards]

AIR | ENGINEERING

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EDITORIAL:

Tension Strikes Again!

A FEW YEARS AGO a workman walked up to his foreman at a labor meeting and shot him dead. Turned out that the foreman had been consistently ignoring the workman on the job for the past six months or so, which made the workman nervous, tense and worried about his job.

Underlying this episode was the real reason why the man shot his boss, why the boss's attitude had changed, and a lesson for all of us in this business of air engineering.

First, the foreman had wife trouble. This made him tense and morose on the job, preoccupied with his own troubles and unable to sense those of the people he led. Second, the workman undoubtedly was extremely insecure and only needed the aggravation of a consistent cold shoulder from his boss to go off the deep end.

Third, the lesson for all of us is that there is far more than money demands underlying the labor strife that cuts deeply into production and product quality.

Money is way down the list of the prime reasons for labor discontent, say social scientists who have long studied human relations in industry.

Heading this list is the total human environment in factory and office. Such simple and inexpensive things like painting walls and corridors with cheerful, mood-creating colors, have worked wonders for morale (and production).

Proper climate control for personnel is another vital factor in creating the kind of atmosphere people *like* to work in. After three or four days of cold, dark, dismal and rainy skies, to come into a cold, dank and dark factory or office is an experience calculated to tense up the most stable of us.

If shop people are continuously exposed to alternate blasts of hot and cold air from a poorly controlled make-up air unit nearby or from unprotected

(Please turn to following page)

Editorial (Cont.)

(Continued from preceding page)

shipping room doors, complaints are bound to take more than verbal form; they'll show up in quantity and quality of work.

If office people are chilled near windows and overheated in interior zones during the winter, or have to put up with the opposite condition in summer, you'll find more mistakes in accounting, typing and more seriously, in judgment.

We urge you to make a critical analysis of the working climate around each of the people in your factory and office building. Or, if you can't make such a survey, give consideration to setting up the machinery of communications from supervisory people, so that complaints about climate will be funneled fast to you, instead of being shrugged off by the worker's boss as just another crackpot gripe.

Gripes have a cumulative effect and after a while, inevitably result in some sort of action, out of all proportion to their cause, that will not be good for the company. Action on your part that indicates a corporate interest in the comfort and working climate of plant personnel can in the long run pay off in working harmony that means top production and sustained product quality.

A complaint may be as simple to handle as the turn of a volume damper or directional register outlet. You may have to buy more sophisticated controls for make-up air units, lower unit heaters to get warmth down to working level, spot more heating equipment in cold places, blanket shipping room doors with warm air.

The important point to keep in mind is not how easy or tough it is to keep everyone satisfied. What's vital here is that you do *something* about each complaint before things get out of hand, grievance machinery starts rolling, people get roiled up.

Better indoor climate working conditions do smooth the path of human relations in industry, alleviate tension caused by thermal discomfort, contribute greatly to top production and improved quality of the products that support your company. ▲▲

Eugene A. Sloane

Editor

Meetings, Courses, Expositions

Western Electronic Show and Convention, *Cow Palace, San Francisco, Aug. 22-25, 1961.*

Joint Nuclear Instrumentation Symposium, *North Caroline State College, Raleigh, N. C., Sept. 6-8, 1961.*

Production Engineering Show, *Navy Pier, Chicago, Illinois, September 6-16, 1961.*

Structural Aspects of Architectural Engineering, *Pennsylvania State University, University Park, Pa., Sept. 10-15, 1961.*

ISA Fall Instrument-Automation Conference & Exhibit, *Memorial Sports Arena, Los Angeles, Calif., Sept. 11-15, 1961.*

Third Annual Southeastern Maintenance and Engineering Show, *War Memorial Coliseum, Greensboro, North Carolina, Sept. 12-14, 1961.*

Seminar for Manufacturing Engineers, *Pennsylvania State University, University Park, Pa., Sept. 12-15, 1961.*

Work Measurement Seminar, *Pennsylvania State University, University Park, Pa., Sept. 17-22, 1961.*

Tenth Annual Standards Engineers Society Meeting, *Hotel Sherman, Chicago, Sept. 18-20, 1961.*

Sampling and Identification of Aero-Allergens, *Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, Sept. 20-22, 1961.*

Industrial Building Exposition & Congress, *New York Coliseum, New York City, Sept. 25-28, 1961.*

American Gas Association, *Dallas, Texas, Oct. 1-4, 1961.*

17th Annual Meeting of American Society of Industrial Designers, *Santa Catalina, California, Oct. 5-8, 1961.*

Western Building Industries Exposition, *Great Western Exhibit Center, Los Angeles, Oct. 7-10, 1961.*

17th Annual National Electronics Conference, *International Amphitheatre, Chicago, Oct. 9-11, 1961.*

First International Convention on Ionization of Air, Technical, Physical and Physiological Aspects, *Ben Franklin Institute, Philadelphia, Pennsylvania, October 16-17, 1961.*

National Metal Exposition, *Detroit, October 23-27, 1961.*

26th Annual Meeting of Industrial Hygiene Foundation, *Mellon Institute, Pittsburgh, Oct. 25-26, 1961.*

National Frozen Food Distributors Assn., *Chicago, Nov. 6-10, 1961.*

Air-Conditioning and Refrigeration Institute (annual meeting), *The Homestead, Hot Springs, Virginia, Nov. 12-15, 1961.*

National Warm Air Heating and Air Conditioning Assn. (annual convention), *La Salle Hotel, Chicago, Nov. 13-16, 1961.*

National Electrical Manufacturers Assn. (annual meeting), *Traymore Hotel, Atlantic City, New Jersey, Nov. 13-17, 1961.*

28th Exposition of Chemical Industries, *New York Coliseum, New York City, Nov. 27-Dec. 1, 1961.*

National Assn. of Home Builders, *Exposition Center, Chicago, Dec. 3-7, 1961.*

Letters

Request To Reprint "In Praise Of Industrial Hygienists"

Editor:

Reference is made to your editorial entitled, "In Praise of Industrial Hygienists," which appeared in the September, 1960 issue of AIR ENGINEERING.

This letter is to request your approval to reprint this article in the Air Force Logistics Command Surgeon's Bulletin.

The article will appear in its original form with the one exception that in the Air Force we use the terminology "sanitary and industrial hygiene engineer" rather than industrial hygienist," and we should appreciate your concurrence in our utilizing this term in reprinting the editorial. A copy of the article as it will appear in the Surgeon's Bulletin is attached for your approval.

Should you desire, we will be happy to make available to you a copy, or copies, of the Surgeon's Bulletin in which this article appears.

C. C. Dills
Lt. Colonel, USAF, MSC
Wright-Patterson AFB, Ohio

Editor's Note:

Approval was given.

Encouraging To See AIR ENGINEERING White Room Coverage

Editor:

Since the reading of your December issue, recommended to us by Mr. Kodel of Sandia, which covered the White Room Symposium and formation of the AACC (American Association for Contamination Control), we at Sparton Electronics in the High Reliability Section have become avid readers of your magazine due to our increasing interest in this area. Each month's issue is circulated in the section for review by all.

It is encouraging to see so much coverage of the White Room subject after such a lack or exchange of information existed in past years.

Our primary interest at this time is to receive any and all information concerning the AACC.

Thank you, and keep up the good work.

G. R. Iemmolo
Sparton Electronics Div.
Sparton Corp.
Jackson, Michigan

Editor's Note:

Anyone wishing information on the forming of AACC (American Association for Contamination Control) circle #200 on the postage-free reply cards located on page 35.

Wants List of Filter Manufacturers

Editor:

We are wondering if you, as specialized publishers on the subject of air and associated products, have a list of manufacturers of filters?

We would also like to know if you "rate" such products, in regard to quality and performance or, if there is an organization in the U.S.A., which does this?

We are interested in both washable permanent type filters and also disposable types.

Peter L. Simpson
Vice President
A. H. Simpson Industries Ltd.
Toronto, Ontario

Editor's Note:

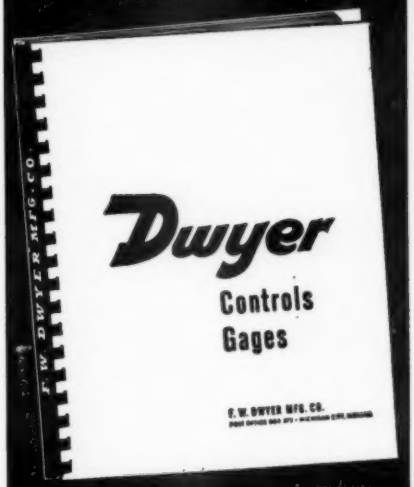
As publishers, we do not feel it desirable to issue ratings on filters.

We suggest to obtain filter ratings methods you contact either the Air Filter Institute, Box 925, Washington 9, D.C., or the National Bureau of Standards.

Use the Communications Center, page 35, to receive more information about any product advertised, any new literature or new product described. Circle the number on the postage-free card that refers to the item of your interest, add your name and address and mail.

To comment, criticize or make suggestions about any feature article in this issue, use the postage-free Editorial comment card.

For the latest in Gages...Controls



NEW

Dwyer

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[Circle #16 on page 35]

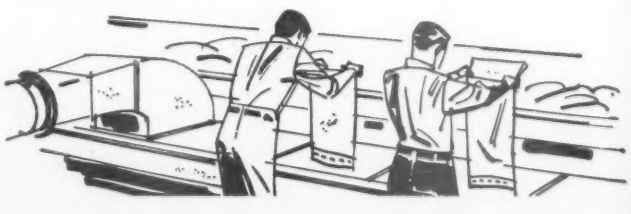
Problem:

BAG SHAKEOUT

The photo gives you a pretty good idea how many mailbags are handled in the U.S. Army Terminal Post Office at Oakland, California. With workers shaking out each bag after emptying, you can imagine the extent of the double problem—worker discomforts and excessive housecleaning costs.

Solution: An automatic dust "pullout" system involving an AAF Type W ROTO-CLONE (A) exhausting a bag-cleaning platform (B). The empty bags are merely shaken slightly over the perforated platform and the ROTO-CLONE does the rest. The collected dirt is turned into a harmless sludge and the air is re-circulated into the room.

Water sprays extend the effectiveness of the wet-collecting Type W ROTO-CLONE to collection of the finest and lightest dust particles. It requires little maintenance, uses a minimum of water and maintains its efficiency regardless of air volume. Perhaps it could solve a problem for you. Bulletin 274 gives detailed product information.



Problem-solving with AAF Dust Control

Problem: LEAD FUMES

A big-city newspaper like the Los Angeles Times-Mirror has to melt lead, and melting lead produces fumes. The problem was how to get the fumes out of the building without creating a new problem — air pollution — in the process.

Solution: An AAF reverse jet fabric arrester — the AMERjet (A) — exhausts the lead melting pot, removes the fumes and dispels nothing but clean air to the Los Angeles atmosphere.

The AMERjet will handle heavy dust loadings of materials of varying nature with a constant pressure drop that assures accurate control. It will collect even invisible particles dry for reclaiming.

Maybe it could solve a problem for you. For complete product information on the AAF AMER-jet, call your local AAF representative or write for Bulletin 279.

Address: Robert Moore, American Air Filter Company, Inc., 305 Central Avenue, Louisville, Kentucky. In Canada, American Air Filter of Canada, Ltd., 400 Stinson Blvd., Montreal 9.

AAF **American Air Filter**
BETTER AIR IS OUR BUSINESS

[For more information circle #17 on page 35 reply cards]

NEWS of the Industry

New Officers For Industrial Gas Cleaning Institute

The Industrial Gas Cleaning Institute, Inc. (IGCI) was founded in 1960 to further the interests of manufacturers of industrial gas-cleaning equipment, by general improvement of engineering and technical standards in the manufacture, installation, operation, and performance of equipment, devising and improving methods of analyzing industrial gases, disseminating information on air pollution; the effect of industrial gas cleaning on public health; and general economic, social, scientific, technical, and governmental matters affecting the industry, together with the views of the members thereon, and promoting the industry through desirable advertising and publicity.

Officers for 1961 have been announced and they are: President, John T. Doyle, Aerotec Industries, Inc., Greenwich, Conn.; Vice President, L. L. Andrus, Wheelabrator Corp., Mishawaka, Ind.; Secretary-Treasurer, John G. Liskow, American Air Filter Co., Inc., Louisville, Kentucky.

Anyone wishing more information about membership application to the Industrial Gas Cleaning Institute, contact Executive Secretary, Industrial Gas Cleaning Institute, Inc., 23 West 45th St., New York 36, New York.

in laying out your client's plant

ARE YOU GUARDING AGAINST DUST DAMAGE TO MACHINES?

Will there be dust-producing machines in your client's new plant? Such as metalworking, wood-working or penumatic conveying equipment? If so, you should plan now for dust control.

Because dust clogs and gums up costly machinery, lowers production efficiency, causes breakdowns and higher maintenance costs. In addition, dust is harmful to the health of employees.

More and more professional men, laying out new plants and remodeling older ones, are specifying Torit Dust Collectors. Torit Dust Collectors have proved 98% efficient in removing dust. They are compact, easy to install and maintain, and cost far less than many types of dust collecting equipment.

Contact a Torit representative. He will give you dust collector specifications, performance charts, dimensional drawings, installation suggestions . . . all the information you need.

Write:

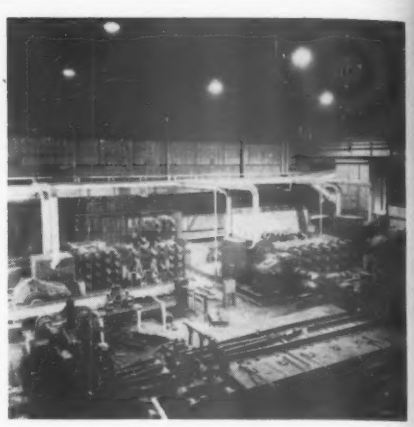
TORIT

MANUFACTURING COMPANY

1133 Rankin St., St. Paul 16, Minn., Dept. 1927

Cyclone model. *Also available in portable cabinet models.*

[For more information circle #18 on page 35 reply cards]



Air Filtration Saves $9,000 Yearly

At the West Virginia Works of Connors Steel Div. of H. K. Porter Co., Inc. air contamination resulted in an annual cost of $9,000 in maintenance and downtime on three synchronous electric motors totaling 2200 hp used to drive their roughing mills.

A Wheelabrator Ultra-Filtration unit was installed removing 99+ percent of the contaminents in the atmospheric air which is piped to hooding over each of the three large motors and results in no motor maintenance nor down-time due to motor breakdown.

N.Y. C. Study Reports Pollution Fatalities

A report based on an incident of air pollution in New York City during November, 1953, that resulted in an increase of deaths for a 10-day period has been prepared by a group headed by Dr. Leonard Greenburg, Chairman, Dept. of Preventative and Environmental Medicine at the Albert Einstein College of Medicine of Yeshiva University, New York City, under a grant from the United States Public Health Service.

A weather pattern known as "anticyclone" dominated the city area from Nov. 12 to 21. This

(Please turn to page 16)

[Circle #19 on page 35]→

Philco Controlled Atmosphere Equipment . . .

the answer to your stringent requirements!

Complete systems, or component equipment . . . designed by Philco because no conventional equipment met Philco's own atmosphere control requirements . . . now production-proved . . . available at competitive prices—including factory service.

Only Philco equipment gives you all these features:

IN DRY BOXES

External bolting flanges and externally mounted lights eliminate internal obstruction, reduce operator fatigue, and assure more hermetic reliability.

Glove mounting design provides constant O-ring compressive tension at every point in the glove's perimeter—for optimum seal.

Moisture content of 10 parts per million, or less—with a Philco-approved recirculating air dryer.

Philco modular dry boxes are available in "L" and "T" groupings for optimum floor layout flexibility. All models are available in either lowest-permeability stainless steel or aluminum. All seams in all models are heliarc welded. All models contain safety glass windows. Modular and individual dust shields feature the same design advantages.

IN VACUUM OVENS

Single rectangular as well as double and triple tubular oven configurations are available. Philco ovens distribute the most even heat possible to the work load—maintain an even temperature control $\pm 2°C.$ at 150°C. to $\pm 8°C.$ at 350°C.—as measured on the inner wall surface.

Vacuum of 5 microns can be reached in less than 10 minutes with recommended mechanical vacuum pump. Higher vacuum is obtainable using optional diffusion pumping systems.

Designed as building blocks for system flexibility, Philco Vacuum ovens are ideally matched with Philco modular dry boxes. They may also be coupled with virtually *any* dry boxes.

Wherever atmosphere control is critical . . . in chemistry, electronics or medicine . . . Philco modular "Building-Block" equipment offers tightest control. For detailed information, write Dept. AE861.

Equipment Development and Manufacturing Operation

PHILCO®

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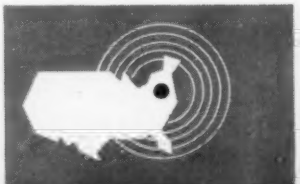


NEWS of the Industry...

(Continued from page 14)

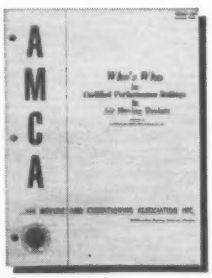
accompanied by a temperature inversion keeping air pollutants near the earth's surface and little wind resulted in an accumulation of air pollutants from the entire area it dominated. This included the industrial regions of Ohio, Pennsylvania, New York, and New England.

Mortality data obtained from the New York City Department of Health, Bureau of Records and Statistics, disclosed a significant increase in the number of deaths beginning on Nov. 15 (3 days after the "incident" began) and extending through Nov. 24. During that period the average daily number of deaths rose from between 218 and 227 to 244. Within these same 10 days in 1953 there were six days on which over 250 deaths occurred. The deaths were generally distributed over all age groups. No other known factors, aside from the air pollution, could be found to explain the increase in deaths during this period.

Who's Who in Certified Ratings?

The first edition of "Who's Who in Certified Performance Ratings" is now available to users and specifiers of air moving equipment. This new publication of the Air Moving and Conditioning Association meets the recognized need for an official directory of manufacturers and products licensed by AMCA to use the Certified Ratings Seal.

The 54-page directory contains essential product identification data on all air moving devices which have been tested and rated for performance in accordance with the rigid requirements of the AMCA Certified Ratings Program. Revised issues will be published periodically.



Copies of Bulletin 261A, "Who's Who in Certified Performance Ratings" are available from: Air Moving and Conditioning Association, Inc., 2159 Guardian Building, Detroit 26, Michigan.

[For more information circle #20 on page 35 reply cards]

Blower Fans Basis For Air Structures

Blower fans manufactured by the Sturtevant division of Westinghouse Electric Corporation are being used in unique air structures manufactured by the CID Air Structure Company of Chicago, Ill.

The air structures are multipurpose buildings constructed from a single vinyl membrane anchored to the ground and held erect by a large volume of low pressure air.

The CID air structures can be used as white rooms, warehouses, forms for sprayed on concrete, construction shelters, etc., either as permanent or temporary facilities.

The air for each structure is supplied by two No. 327 Vaneaxial fans that operate continuously. Each delivers 15,000 cfm of air at 1-in. static pressure.

A 40-by-80-foot air structure can normally be erected in less than one day or taken down in ½ day. It takes about ½ hour to inflate this smaller size structure with the Vaneaxial units. Larger sized structures are also available.

A Step Backward!

Chicago's appeal board has overruled its air pollution control board to permit installation of 28 flue-fed

incinerators in apartment buildings to be erected by the Chicago Housing Authority. This, said T. H. Carey, air pollution control director, is "a serious step backward in the battle to prevent air pollution."

BNPCo Has New Book Division

In a move to expand its activities in the field of technical books and manuals, Business News Publishing Co. (BNPCo), Detroit, publisher of AIR ENGINEERING, has established a Technical Book Div., announces E. L. Henderson, president.

The company has long-range plans to publish and distribute new technical books, service manuals, and related material in addition to revising a number of the popular air conditioning and refrigeration service manuals it has published over the past 30 years, Henderson explained.

Heading the new division as general manager will be C. Dale Mericle, who for 17 years has been associate editor of the sister publication AIR CONDITIONING, HEATING & REFRIGERATION NEWS and has also edited many of the company's present service manuals in addition to authoring a four-volume series "Servicing Automobile Air Conditioners."

Air Condition Low Income Apartments

Worthington Corporation has received a contract from Afgo Engineering Company, Brooklyn, New York to supply air conditioning units for mammoth Penn Station South, a $35-million low income cooperative housing project currently under construction in the Chelsea area near Pennsylvania Station, Philadelphia.

According to Worthington this is the first time that a housing project of this type will be completely air conditioned.

Under joint sponsorship of the International Ladies Garment

(Please turn to following page)

PHOTOGRAPH COURTESY OF WESTERN ELECTRIC COMPANY

Angelica Uniforms and Victor Gloves Help Prevent Clean-Room Contamination

Victor Monofilament Nylon Gloves

Angelica has been appointed the only distributor of Victor Gloves, the finest protective gloves made. Victor's non-contaminating gloves of monofilament nylon with plastic coated palms, have maximum touch sensitivity for precision operations. Victor Gloves Inc. collaborated with Bell Laboratories, Inc., in developing these gloves and Bell is currently using them in the assembly of select devices sensitive to physical and chemical contamination.

Other models include ambidextrous gloves and gloves for LOX parts.

Static-Free Dacura* Uniforms

Angelica's coveralls and frocks, of comfortable moisture absorbent Dacura (Dacron** polyester and rayon), are non-linting, acid resistant and static-free. The tight weave of continuous filament yarns resists passage of contamination from the skin or undergarments.

There is a complete "engineer designed" line of Dacura, Dacron, or nylon uniforms and accessories by Angelica and Victor Gloves Inc.

Mail this coupon to the nearest Angelica office below.

*Reg. T.M. H. P. Ogden Co.
**Reg. T.M. of Dupont

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UNIFORM COMPANY

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Send literature on White Room Uniforms and Gloves.

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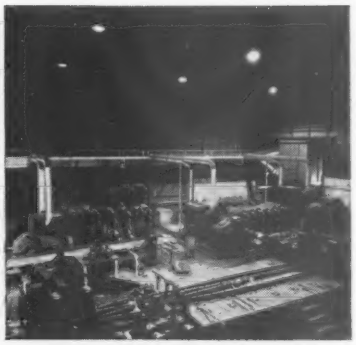
[For more information circle #21 on page 35 reply cards]

Wheelabrator ultrafiltration provides air cleaner than you breathe



In this mill room, a Wheelabrator Ultra-Filtration® unit has eliminated the cost of 24 man-hours of maintenance labor a week in upkeep of 3 roughing mill drive motors.

A demonstration of WHEELABRATOR'S

VITAL VALUES

Air that's pure—really pure—is vital to the operation of steel mill drive motors. And ultimate purity of the filtered air is one of the Vital Values you get with Wheelabrator Air Filters. At a prominent steel mill, installation of Wheelabrator Ultra-Filtration to provide clean air to three drive motors totaling 2,200 h.p. has virtually eliminated weekly motor maintenance attention, saving $3,120.00 in direct labor cost alone per year. Added to this saving, mill room down time costing $6,000.00 annually due to motor trouble has been avoided. Wheelabrator Ultra-Filtration provides the air purity required, at a cost far lower than many systems offering less efficiency. Get the whole story of these vital savings. Write today for information.

VITAL VALUES FOR INDUSTRY

WHEELABRATOR AIR FILTRATION

WHEELABRATOR CORPORATION, 498 S. Byrkit St., Mishawaka, Indiana
In Canada: WHEELABRATOR CORP. of Canada, Ltd. P.O. Box 490. Scarborough, Ontario

[For more information circle #22 on page 35 reply cards]

NEWS

(Continued from preceding page)

Workers Union, and United Housing Foundation, the project being built by Mutual Redevelopment Houses, Inc. calls for the construction of ten 20-story apartment houses, serving 2,820 families. Worthington is providing 6700 fan coil air conditioning units—the largest single order of its kind in the company's history.

Located in a six block area running from 23rd to 29th Streets, between Eighth and Ninth Avenues, the development will include a shopping center, playgrounds, parking facilities, gardens, as well as service and community rooms.

Apartments will range from 2 rooms to 5½ rooms. Tenant owners will invest approximately $650 per room. Rentals are expected to average $22-23 per room per month.

The Worthington fan coil air conditioning units in the new development consist of a basic water coil and air distribution fan with speed switch, control valve, motor and filter.

99% Efficiency Cleaning Boiler Fly Ash Particles

Efficiencies in excess of 99 percent, among the highest ever achieved in collecting fly-ash particles from boiler gases by a public utility have been recorded by Pennsylvania Electric Company in recent tests at the Seward Generating Station. Two electrical precipitators, engineered and manufactured by Research-Cottrell, Inc., help to achieve this efficiency by removing more than 100 tons of the finer fly-ash particles daily.

Mechanical dust collectors remove larger particles before the boiler combustion gases enter the precipitators which have guaranteed efficiencies of 98 percent in removing even sub-micron fly-ash.

Pulverized-coal-fired boilers at Seward produce 600,000 pounds per hour of steam to drive a turbine with a net capability of 51,700 kw. The two smoke cleaning precipitators are designed to handle 360,000 cfm.

New Type Pneumatic Classifier Ends Dust Problems

Gravitational inertial type dust classifier recovers enough phosphate fines to pay for itself in a year, end air pollution problem in plant.

THE AMERICAN AGRICULTURAL CHEMICAL COMPANY has put into operation two new type high-efficiency pneumatic classifiers to separate fines from phosphate rock at its plant in Pierce, Fla.

Advantages were threefold: (1) phosphate fines reclaimed paid for the new units in less than a year, (2) eliminated a long-standing dust problem and (3) high 95 percent separation efficiency, commercially unobtainable by any other method.

Dust difficulties resulted from dumping of fines of less than 100 mesh into the same silos as larger particles. Phosphate rock larger than 100 mesh settles readily and creates no dust problem, whereas much of the 100 mesh material rises into the atmosphere and is lost. It was to separate the -100 mesh material from the aggregate and enable its independent collection that the classifiers were installed.

High classification efficiency was desired because presence of fines decreases value of the coarse and, at the same time, any coarse carried away with the fines would be disposed of at less than its full economic value. Also, excessive coarse material in the fines would hamper the operation of the pneumatic handling system used to transfer fines from the classifier to storage. Fines are stored with a finished milled product, whereas they were formerly lost to atmosphere.

Each classifier processes the solids collected by a group of cyclones which cleans the exhaust gases of a rotary dryer. There are two dryers, each served by an independent group of cyclones, and solids from each group are conveyed to the respective classifier by screw conveyor.

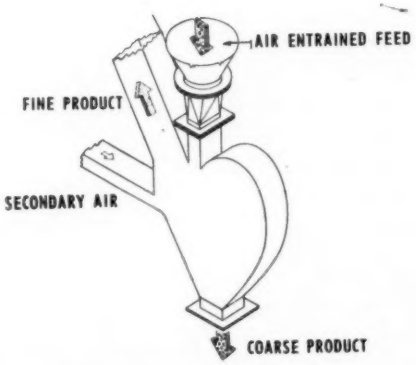


Fig. 1: Schematic shows material flow through classifier.

Fig. 1 is a schematic diagram of the classifier (see also Fig. 2). Phosphate rock and room air enter at the top through a vertical inlet duct and travel downward. Particles larger than 100 mesh discharge from bottom of unit into the bucket elevator system which handles phosphates from the dryer. Material of less than 100 mesh is drawn off through an inclined duct at one side of the classifier. It travels upward into a cyclone which separates the particles from the airstream and discharges them into a hopper. The hopper in turn empties into a pneumatic conveying system which delivers the fines to an enclosed storage bin. Cleaned air from the cyclone goes into dryer's gas exhaust ducts.

Overall result is that coarse material is stored in open, dust-free bins, while lighter particles—instead of being discharged into the air and wasted—are stored separately.

The "Gravitational-Inertial" classifiers separate fines from feed material by controlling aerodynamic forces in a manner not previously utilized in classification work. The entering airstream makes a sharp "U" turn into the inclined discharge duct shortly after entering the classifier and simultaneously sets up a counter clockwise eddy current in the body of the classifier. Vanes at the mouth of discharge duct aid in control of airflow. Fine material is carried out with the airstream but coarser material cannot make the turn and continues downward. A secondary air supply crosses the coarse material near the bottom outlet and scrubs away any fines adhering to the larger particles. Secondary airstream, reinforcing the eddy current, travels around inside of classifier and exits through exhaust duct. The eddy current provides a moving wall containing

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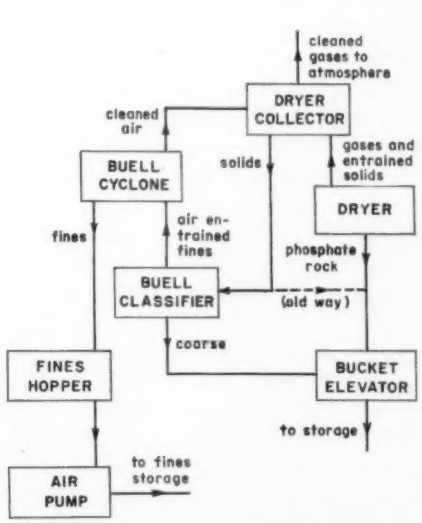


Fig. 2: Flow chart of phosphate fines through classifier and collection equipment.

How To Control
Temperature
Pressure
Humidity
In Super-Clean Areas

by C. E. Schwab
Application Engineer
Barber-Colman Company

Above: Super-clean room at New Departure Div. of General Motors, used for final assembly of ultra-miniature precision ball bearings.

Selection and use of controls for precise degree of thermal environment in contamination control areas.

SUCCESSFUL CONTROL of temperature, humidity, and pressure in "white rooms" depends primarily on proper design and selection of mechanical equipment, including control and air distribution devices.

Sizing the equipment to the load is extremely important, since oversizing as well as undersizing can create conditions which are uncontrollable. Controls should be considered as a basic part of design, rather than accessories to be added later. Temperature and humidity requirements will determine system design and quality and type of control system.

On-off control of a compressor or liquid line solenoid, is commonly used for temperature and humidity control. With well designed air distribution, this is satisfactory for normal comfort control or where requirements merely call for a high limit on space humidity. On-off control of cooling and humidity is not recommended for precise humidity control, since variations caused by on-off cycles will usually exceed allowable deviation from humidity control point.

A typical system using on-off control of refrigeration is shown in Fig. 1. Temperature control is

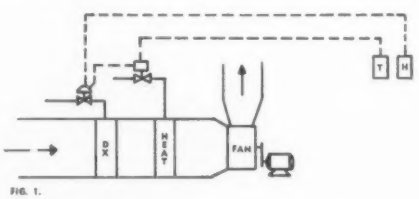


FIG. 1.

maintained by a room thermostat and proportional valve. The valve is equipped with neutral band linkage which provides means for sequence operation of heating and cooling. On a call for cooling, the valve gradually closes until it is tightly closed. On further call for cooling, the valve operator continues to run through a neutral band, then energizes the cooling circuit through an end switch.

The end switch may be one or two stages as required. A two-position humidity control is connected in parallel with the end switch and energizes the cooling circuit on a drop in humidity. Since reheat may be required during periods of dehumidification to maintain dry bulb temperature, a constant source of heat is required year around. Following are control characteristics of this system:

A. Will give adequate comfort control if equipment is properly sized. Also acceptable for high limit

humidity control. Precise control of humidity for laboratory type conditions is questionable.

B. If a discharge element or low limit is used, it must be removed from the circuit on the cooling cycle, or excessive cycling will result.

C. Electric or electric-electronic controls may be used. Several combinations of temperature and humidity controls are listed below in order of best control operation:

(1) Electronic temperature and electronic humidity. Fast response of the electronic controls provide maximum stability and accuracy within limits of system design.

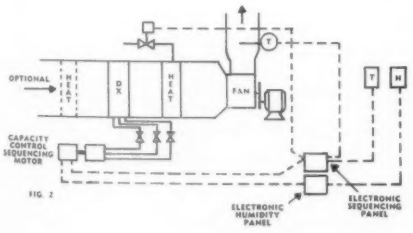
(2) Electronic temperature and electric humidity. Good temperature control for comfort conditions with some cycling of humidity conditions.

(3) Electric temperature and electric humidity. Average comfort control of both temperature and humidity conditions.

(4) Electric temperature and electronic humidity not recommended. This combination will have a tendency to be unstable because the sensitive humidity control will cause dry bulb temperature to change more rapidly than a mechanical type temperature sensing device can sense the change.

(5) Electric or electronic control of temperature without a neutral band between heating and cooling is not recommended. Excessive cycling will result.

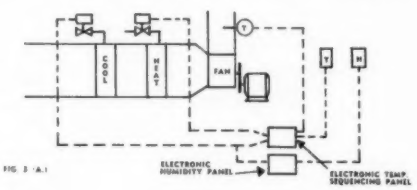
Obviously, direct expansion cooling presents a problem on precise control applications because it is basically on-off in operation. Multistage operation and/or mechanical unloading improves the controllability of direct expansion. In this case, the control system will consist of sequence operation of heating valve and refrigeration capacity controller, with humidity override of refrigeration. Refer to Fig. 2.



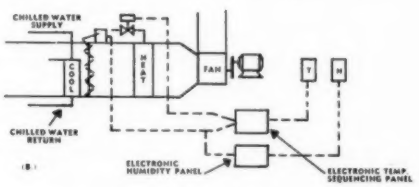
A typical electronic system consists of room and discharge elements controlling a proportional valve and sequence motor through an electronic sequencing panel. On a drop in humidity, the electronic humidity element and panel override the temperature control to increase refrigeration capacity. The temperature control will then open the valve to provide reheat and maintain dry bulb temperature.

A heating coil is sometimes installed ahead of the direct expansion coil, sized just large enough to prevent the compressor from shutting off completely and thereby eliminating one source of two position cycling. Correct sizing and engineering of the refrigeration system and its capacity control system is extremely important.

Chilled water cooling (Fig. 3A) provides stepless control of cooling and humidity. For control pur-



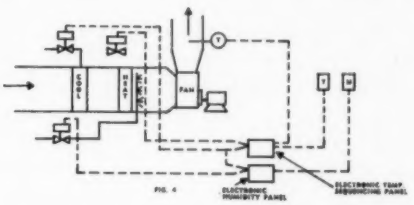
poses, this is superior to direct expansion cooling. A central chilled water source or package chiller provides chilled water to the unit. Final control is provided by the 3-way valve actuated either in sequence with the heating valve, or by the humidity control. A similar system is shown in Fig. 3B, with face and bypass dampers. Since



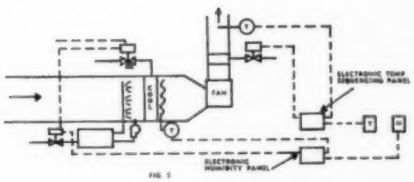
there is continuous flow of chilled water in the coil, this system is better on applications with a high latent heat load.

Systems in foregoing discussion cover applications which limit space humidity, but do not add moisture to the air. Addition of moisture is commonly accomplished with a pan-type humidifier or a steam grid humidifier. With appropriate temperature controls, a complete temperature-humidity control system is thereby provided. The steam grid is inherently faster in response than the pan-type humidifier, and combined with fast response of electronic humidity controls, the steam grid is easier to control accurately than the pan type.

In Fig. 4, electronic controls are provided on temperature and humidity. The heating and cooling



valves are operated in sequence by the temperature control to maintain desired dry bulb conditions in the space. The steam grid is operated in sequence with the cooling valve by the humidity control, overriding the temperature control when necessary to open the cooling valve for dehumidification purposes. Since space humidity will vary along with dry bulb variations, fast responding electronic controls for space dry bulb control are preferred. For additional stability, a discharge element should be used to compensate for small changes in discharge temperature.



Dew point control (Fig. 5) depends upon maintaining a given saturated air temperature (dew point) down stream from a sprayed coil. Space temperature is maintained by control of the reheat coil, from a room sensing device. This system works on the premise that the air downstream of the cooling coil is fully saturated, but in practice full saturation is usually not accomplished. To compensate for this difference, a humidity element is installed in the space. This element resets the dew point temperature control according to deviation from desired humidity conditions in the space. An electronic humidity compensator bridge is used, which provides adjustment of humidity to temperature ratio.

The dew point control system is best explained by reference to the psychrometric chart. Assume desired humidity is 50 percent RH with 74°F. dry bulb in the space. The 50 percent RH curve inter-

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sects the 74° dry bulb line at 54° dew point. It is evident that 50 percent RH can be maintained in the space if the 54° dew point temperature is accurately controlled, space dry bulb does not change, and there is no additional moisture gain in the space. Also to be noted is the fact that one degree change in space dry bulb will cause approximately 2 percent change in relative humidity at a given dew point. Space temperature control, therefore, should be electronic to give maximum stability and accuracy. Reset of dew point from space humidity sensing is desirable to compensate for above variables.

Summary: In design of control systems for constant temperature-constant humidity applications, it can be concluded that:

1. Selection of control systems should be integrated with design and selection of mechanical equipment. Careful sizing of equipment to load is of prime importance. Controls cannot be expected to compensate for an undersized, or greatly oversized system.

2. On off control of direct expansion cooling is acceptable for comfort control or high limit humidity applications. Multistage or proportional control of cooling and heating is required for precise control.

3. Fast responding electronic controls produce better stability and accuracy than mechanically actuated sensing devices.

4. Dew point control with reheat, or a system with humidifier as well as cooling and reheat coils (allowing separate proportional control of both temperature and humidity) are required to maintain precise control of temperature and humidity under all conditions.

Static Pressure Control

Control of static pressure in white rooms is often as important as temperature and humidity control. Some white room applications require positive air pressure in the space to prevent contaminated atmosphere from outdoors or from other interior areas. Other requirements call for negative pressure differential between the room and other areas to prevent contaminated air from leaving the room except by the exhaust system.

Either of above conditions of pressure balance can be determined in system duct design and choice of supply and exhaust fans. Cfm supplied must exceed cfm exhausted to maintain positive pressure, and vice versa for negative pressure. Since excess supply air must come from outside (or other external area), a positive pressure system must be designed to produce space pressure with outdoor air damper in minimum position.

Final pressure conditions are adjusted when the system air distribution is balanced. Pressure balance would then remain constant if no mechanical changes occurred, and exhaust remained constant.

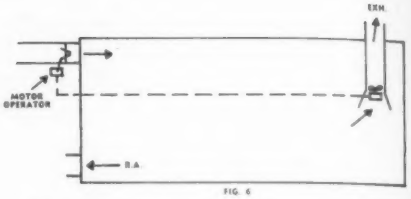
Air Pressure Changes

Changes in air supply pressure are caused by dirty filters, clogged outdoor air intakes, worn fan belts, tampering with balancing adjustments, etc. Controls are required to detect and compensate for these changes, as well as changes in exhaust air volume.

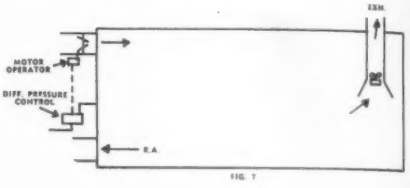
Controls on simple systems consist primarily of warning devices used as an aid in a preventive maintenance program. Differential pressure indicators across filters are commonly used to energize a warning light or signal, or to actuate an automatic device which indexes the filter. A differential pressure control can also be used to detect and signal a change in pressure between the space and outdoors or other surrounding areas. Such a control can be selected in an appropriate range to provide lead time for maintenance procedures.

Exhaust hoods which are intermittently used present the problem of maintaining desired pressure conditions in the room. Pressure balance can be maintained if supply air quantity is increased proportionately when power exhaust fans are turned on. This can be done in several ways:

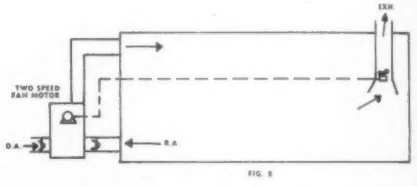
1. Electrically interlock the hood exhaust fan motor (or damper motor) with a two-position motorized damper in the supply duct. Supply air volume is increased a fixed amount whenever the exhaust hood is operative. This system is relatively simple, although no compensation is made for variations caused by dirty filters or other ob-



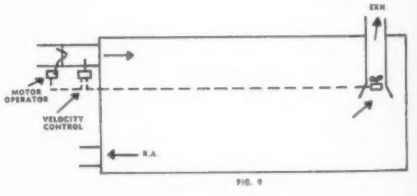
structions in the supply system, Fig. 6.



2. Operate a motorized damper in the supply duct from a differential pressure control to maintain desired room pressure. This method directly controls differential pressure between the room and external atmosphere, and compensates for system variables, Fig. 7.



3. Increase supply fan speed from an interlock circuit on the exhaust fan. This is a simple system with no compensation for variables, Fig. 8.

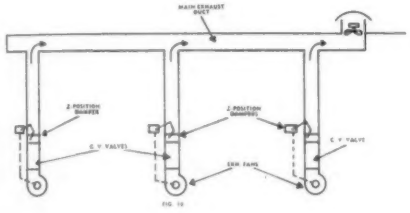


4. Reset the control point of a velocity control in the supply duct to increase supply air volume (Fig. 9) when the exhaust hood is in use. This system positively determines cfm supplied to the room. When exhaust is on, cfm is increased a fixed amount to compensate for exhaust.

Exhaust air quantity from a given system can be affected by changes in static pressure in the exhaust duct. This is especially true when several hoods are connected to a common exhaust duct (Fig. 10). Each exhaust should have a two-position damper to stop air flow when exhaust is not required.

Some means should also be provided to maintain constant volume from each exhaust duct. This can be accomplished with a pressure actuated constant volume valve. This type of valve is self-regulating, deriving its power from static pressure differential across the valve. Most such valves can be factory or field adjusted for a given cfm, and have the advantage of simple operation without motor actuated dampers.

Self-actuated constant volume valves require a minimum pressure differential across the valve of approximately .5-in. w.c. If this is not available, pressure can be controlled with a motor actuated damper and a velocity sensing device. Electronic or mechanically actuated sensing devices are available for this application.



With reference to Fig. 10, regulation of static pressure in the main exhaust duct is sometimes used as an economical way to control static pressure in each branch duct. It should be noted that static pressure control of the main duct can only control the pressure at one point where the sending capillary is located. Pressure in the remainder of the duct will vary as individual exhaust fans are turned on or off. Best control, therefore, is obtained by controlling velocity from each exhaust hood.

Previously described applications include controls actuated from static pressure, differential pressure and velocity pressure. Self-actuated controls were also discussed. Following is a brief description of each:

1. *Static pressure* with electric or pneumatic controls employ a diaphragm actuated device with its sensing tube tapped into the side of a duct. Static pressure between the duct and atmosphere moves the diaphragm to actuate contacts or pneumatic transducers (Fig. 11).

Electronic static pressure control employs a resistance sensing element incorporating a heater.

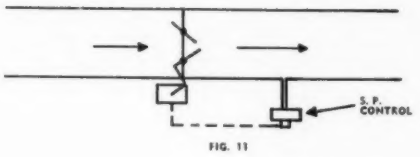


FIG. 11

The amount of heat removed from the element is a function of the air velocity across the element. If the element is installed in a sam-

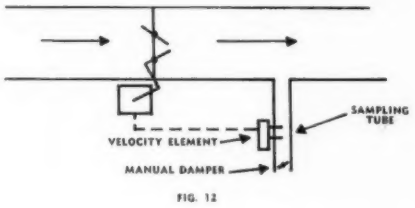


FIG. 12

pling tube (Fig. 12), the velocity through the tube is a direct function of the static pressure in the duct, and the element will produce a control signal proportional to static pressure.

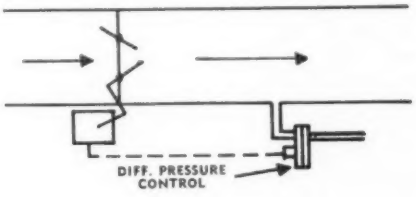


FIG. 13

2. *Differential pressure* is most commonly controlled with a diaphragm actuated controller which actuates a transducer in a proportional or two-position manner. A sensing tube is connected to either side of the diaphragm causing movement proportional to pressure difference (Fig. 13).

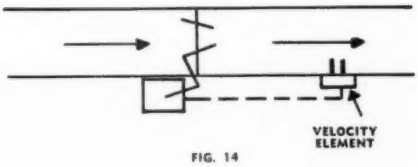


FIG. 14

3. *Velocity pressure* can be controlled with an electronic velocity control described above, installed in the duct as shown in Fig. 14. The resulting control

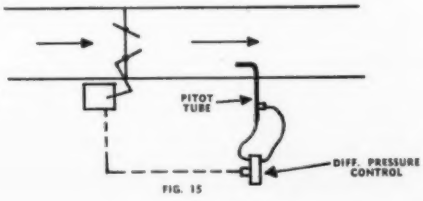


FIG. 15

signal is proportional to air velocity.

A diaphragm actuated differential control can be applied as a velocity control when used with a pilot tube (Fig. 15). The controller senses the differential between static and total pressure. Since total pressure = velocity pressure + static pressure, the controller operates as a direct function of air velocity.

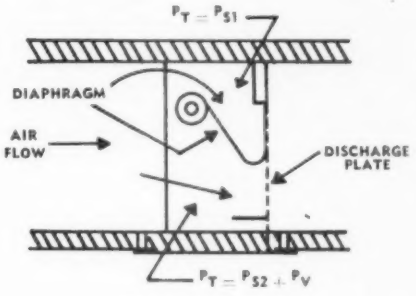


FIG. 16

4. *A self-contained constant volume device* is shown in Fig. 16. A diaphragm is spring loaded to balance against a static pressure differential. The differential static pressure is created by the trapping of air above the diaphragm (see Fig. 11). Since the air above the diaphragm is not moving, its static pressure is equal to the total pressure. Just below the diaphragm the air is moving through the discharge plate and here the static pressure equals this total pressure minus velocity pressure.

If the upstream air pressure increases, the differential pressure will also increase and the diaphragm will move until it is balanced by the spring force. This movement will cover up more of the holes in the discharge plate, and thus will maintain the delivered cfm at a constant value. Conversely, a decrease in upstream air pressure will lower the static pressure differential and the spring force will move the diaphragm to uncover more holes in the discharge plate.

Variations in space pressure controls are numerous, and only typical applications were discussed here. System requirements will dictate system design; system design and controls used are interdependent factors which must be coordinated to produce desired results. ▲▲

How To Air Condition Bottling Rooms To Aid Sales . . . Speed Production

Sources of heat and moisture in bottling rooms and how to remove them for comfort of plant personnel and visitors.

by John Shaw
Coca Cola Company

THE HEART of a soft drink production plant is its machinery area. This area is nearly always the part of the plant that costs the most money, the part that frequently houses a quarter of a million dollars worth of machinery, and the part that the bottling plant owner must show first in his plant tours.

Machinery manufacturers, quick to realize the advertising value of a machine that is good-looking, have often gone far belond the requirements of quality to manufacture a machine with aesthetic lines as well as with functional qualities.

Architects have frequently designated the bottling room area for public display by constructing it as a separate room, fronting it with glass and accentuating the spotless appearance of the room by using vari-colored faience finishes of tiles and enamels which emphasize the shining stainless steel and white-painted machinery used in this room.

Plant tours are now a well-accepted part of our total merchandising and advertising program, and it is generally the aim of management to make this area a showplace where the Bottler can exhibit the cleanliness of his processes and procedures to the public.

Nor is attention to this area purely for aesthetic reasons. Necessity for faultless quality control is now an accepted part of most Bottlers' programs as well as becoming, in varying degrees, a part of the by-laws and codes of many authorities.

I have painted a picture of the desirability, the necessity, for making this bottling room a showplace.

Imagine, if you will, the surprise of a visitor on entering this room. A steamy, hot and humid atmosphere often prevails, employee discomfort is high, tempers are short, worst of all, public reaction is poor. The room is spotless but the air is dust laden, certainly not a type of atmosphere under which you would expect a careful quality process to be conducted.

Just how much dirt or dust is in the air?

Dr. Lewis McCabe, a member of the National Advisory Committee on Atmospheric Pollution, states that a dirt fallout of 50 tons/sq. mile/month is not uncommon in large polluted cities. Even Washington, D. C., has an average fallout of 34 tons/month, and one city, in the same year, had a fallout of 200 tons/sq. mile/month.

Of particular interest is Dr. McCabe's prediction of the future. He says that this fallout is likely to increase rather than decrease as the population and industrial and other activities multiply.

Practically all of these outside air pollutants are filterable by using either a mechanical type of disposable filter or an electrostatic air cleaner, with up to 95 percent efficiency.

In summer the average bottling room pulls in 35 to 40 air changes per hour of this dust laden outside air. To thoroughly clean this considerable volume of outside air

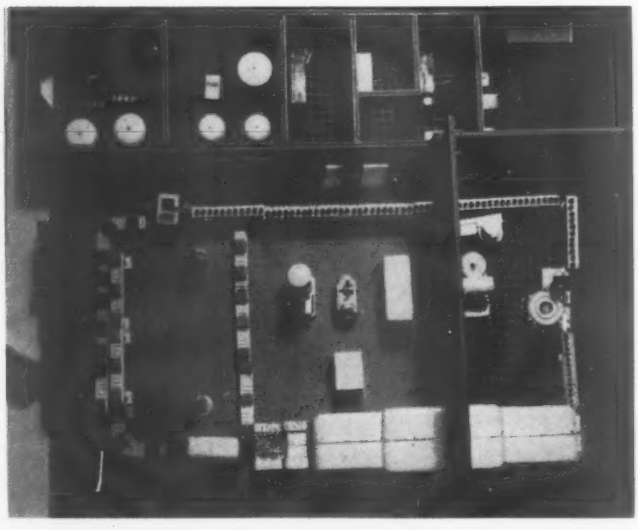


Fig. 1: Washer is half in and half out of bottling room, a condition which can create severe moisture problems costly to handle with air conditioning.

would be costly and in many cases impractical.

Some means must then be found to reduce the volume of incoming air. This can be done by cooling the air, thereby decreasing required air change rate from 35 to 40, to about 8 to 10 changes per hour.

Why this difference in change rate when using refrigerated air?

On a hot day we are all familiar with the amount of ambient air required to cool us. Under average conditions we have to stand quite close to a fan and a considerable velocity of air is required to move over for necessary skin cooling to produce the sensation of body cooling. This isn't true in an air conditioned room — a relatively slight velocity of air is all that is required to cool us.

Hot, humid air takes a lot of air to cool; cold, dry air takes a small amount.

Air Conditioning Layouts

Let us look now at what it takes to air condition a bottling room. The first thing one thinks of is the bottle washer—a heat and steam producing object that usually sits in the bottling room and that gives off a considerable quantity of heat. Many people have said that it is impractical to air condition this room because of this machine. There are four different basic types of layouts that have been tried—let's look at them.

Entire washer in a separate room . . . means in this instance the washer is located in a separate room from the filler. This procedure could raise production flow problems.

Washer projecting a few inches through the wall . . . here in the slow speed line the layout has the disadvantage of the number of bends between washer discharge and filler. However, in a high speed layout it has the advantage that you can provide plenty of storage space for empty bottles between washer and filler. This layout generally requires that the area be specifically designed for this treatment, because the washer projects back into the stock room, thereby making it unsuitable for some arrangement which cannot spare this amount of depth for this type layout.

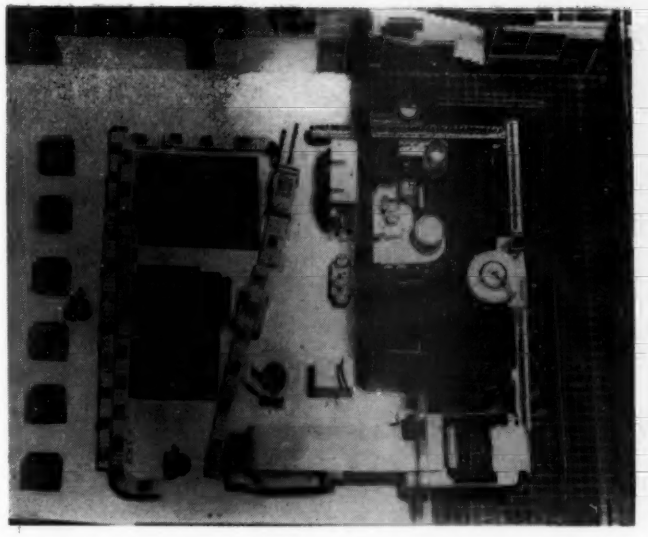


Fig. 2: Here the washer is one-fourth in the bottling room. A dog-leg partition, however, keeps the moisture and heat producing area out of bottling room.

Where a slow speed or medium speed unit is required the following two arrangements have been used.

Washer half in and half out of room . . . the arrangement (Fig. 1) has the disadvantage that it allows a portion of the hot part of the washer to project into the room. This disadvantage can be eliminated, however, by erecting a dog-legged partition which excludes the hot part of the washer out of the room.

Washer one-fourth in, with dog-leg partition . . . Figure 4 shows a dog-leg partition, in which the washer is kept outside the bottling room, yet with important space for the cooling, carbonating, filling, inspection arrangements. There are, then, two best solutions to the problem:

1. For the high speed line, place entire washer behind partition.

2. In the slow speed or medium speed line, construct a dog-leg partition as shown in Fig. 1.

Many people have voiced the opinion that it is entirely impractical to air condition this room with a washer in it. To analyze the validity of this argument we took tests on the surfaces of an operating bottle washer.

Temperatures were measured at regular intervals along *all* surfaces of the washer. Temperature of the clean bottles emerging from the discharge was also taken, horse power of the motors and a calculation made of the heat given off by these units under load conditions. These temperature figures were then translated into Btu to arrive at the amount of heat emitted by the unit; and, concurrently, the amount of refrigeration required to dissipate this heat.

The series of measurements shown in Chart I is based on certain specifics:

1. A recommended reasonable wet and dry bulb ambient temperature.

2. A specific bottle washer.

3. This washer is completely sealed except for its discharge and load ends.

4. An assumed air velocity of 50 fpm which is the normal speed of air circulation under refrigerative cooling conditions and is one of the factors that determine the amount of air cooling required to cool this heated air.

5. This calculation is for the bottle washer only—employee latent heat load, other machinery or external heat loads are not considered—the purpose of this calculation is limited to the amount of air cooling required to dissipate the heat liberated by the bottle washer only.

The deductions that can be drawn from Chart I are that if a separate bottling room can be built and the partition located at a strategic point (in the example shown it was found to be 12 ft. from the discharge end of the washer), then not more than two tons of refrigeration will be required to dissipate the sensible heat from this unit.

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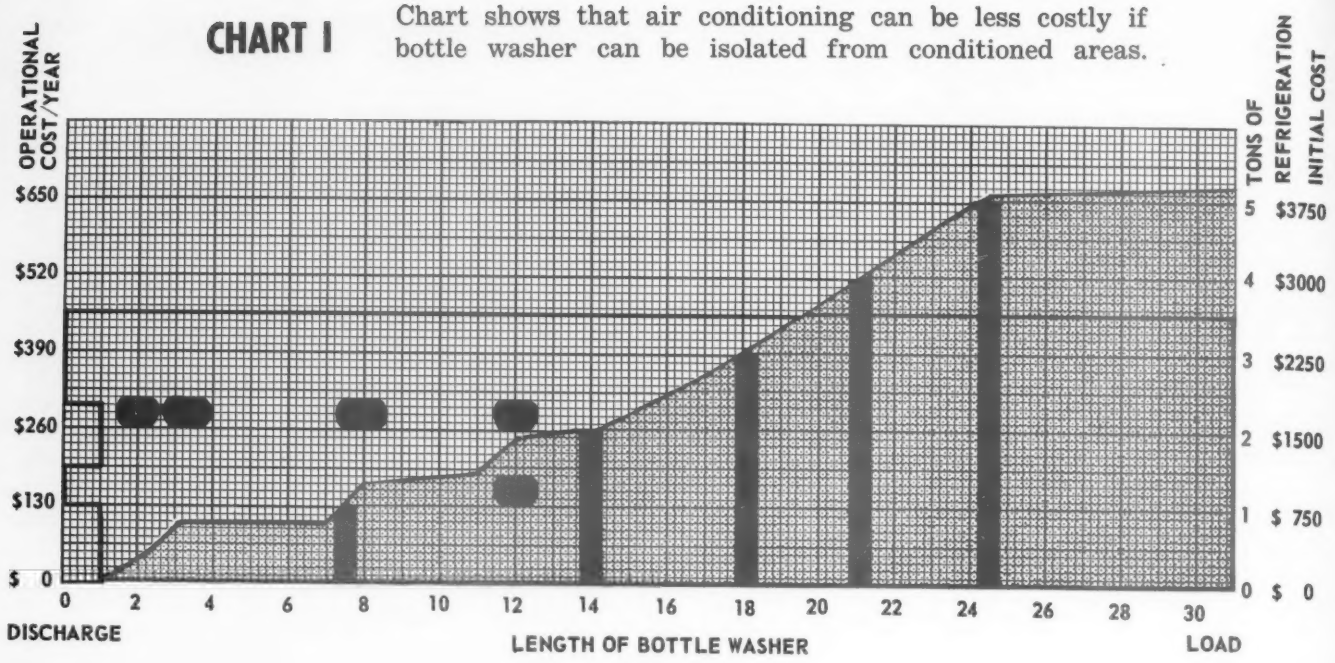
CHART I Chart shows that air conditioning can be less costly if bottle washer can be isolated from conditioned areas.



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The latent heat can be dissipated by relatively minor modifications to most washers; water locks on lids, erection of a stack to remove some steam from the bottle washer; all these are things that have been done with success.

Improved operation of electronic bottle inspection machines and other equipment in a dry atmosphere is well established. Air conditioning with its control of humidity offers this. Improved employee morale both in regard to the conditions under which they work and pride in their part of production under quality conditions, is a valuable asset.

Cost is slight in terms of advantages. Quality, employee morale, machine efficiency, public relations. The cost for both cleaning and cooling will depend on the size of the room and the heat loads that can be excluded, but has in many cases been as low as one-percent of the machinery cost; surely a small cost when compared to the cost of a production line.

It is thus quite within the realm of economical feasibility to provide air cooling and cleaning in a properly designed bottling room. Heat from an average bottle cleaning machine is not a serious deterring factor. In fact, our research has shown that providing cool, clean air to this essential sanitary process is and can be well within the reach of all bottlers building new plants. ▲▲

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Filter Cloth Comparison Chart

Types Of Cloths Commonly Used In Dust and Fume Collectors

FABRIC	MAXIMUM TEMPERATURE °F	RESISTANCE TO			RELATIVE COST FINISHED BAGS COTTON = $1.00			
		ACIDS	ALKALIS	ABRASION				
Cotton Sateen	180°	Low	Fair	Excellent			Staple:	$1.00
Nylon	225°	Low	Excellent	Excellent	Filament:	$1.65	Staple:	2.00
Orlon	275°	Excellent	Fair	Good			Staple:	1.55
Dacron	275°	Excellent	Excellent	Good	Filament:	1.50	Staple:	1.90
Giberglas (Silicone Treated)	550°	Good	Fair	Fair to Low	Filament:	1.80	Combination:	2.50

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Industrial Heat And Its Control

Part II takes up simple methods of determining degree of heat stress to which workers are subject, plus means of selecting methods of alleviating heat stresses.

Part II

by **Robert C. Lemke***
Industrial Hygiene Engineer,
Michigan Dept. of Health

IN THE JULY ISSUE, Part I covered the theory of heat gain, physiological mechanisms involves, benefits of adequate heat stress control methods, instrumention and heat balance.

Heat Stress

We can not always dissipate the required evaporative heat loss to the surrounding atmosphere because of the environmental limitations imposed on the body's evaporative cooling system. Air velocity (V) and vapor pressure (P_a) of the moisture in the air govern the amount of heat that can be lost through evaporation. Maximum evaporative capacity (E_{max}) represents the maximum amount of heat that can be lost by the body in a given environment. Maximum evaporative capacity, as shown in the sample problem, compared with the amount of evaporative heat loss required by the body in the same environment is the basis for the Belding, Haines and Hatch *Heat Stress Index.*

Heat Stress Index (HSI) values are the ratio of required evaporation to maximum evaporation times 100. An HSI value of 100 represents a condition where maximum and required evaporation rates are the same. Index numbers less than 100 indicate a condition where a maximum evaporative capacity is greater than that required, while conversely, index values greater than 100 represent a condition where maximum evaporative capacity is less than that required by the body.

Maximum evaporative capacity is also limited by another factor, the worker's ability to produce sweat. The sweat rate for an average man is one liter of moisture per hour. A total of 2400 Btu is required to evaporate a liter of moisture. Therefore, maximum evaporative capacity is limited to 2400 Btu per hour even under favorable conditions. In the HSI computation, E_{max} is limited to 2400 Btu per hour even when the calculated value exceeds this figure.

Maximum Exposure and Recovery Time

Maximum exposure hours and recovery time calculations are based on the fact that the average man can tolerate at the most a 2°F body temperature rise and that his temperature will rise 2°F for each 250 Btu gained. The maximum number of exposure hours (H_a) is represented by the following equation—

$$H_a = \frac{250}{E_{req} - E_{max}}$$

Similarly, in a recovery environment where the maximum evaporation rate (E_{max}) is greater than the required evaporation rate (E_{req}), the hours required to regain heat balance is represented by:

$$H_r = \frac{250}{E_{max} - E_{req}}$$

To determine recovery hours, maximum evaporation and required evaporation would have to be determined with a specific recovery environment in question.

Weighing the heat stress index by multiplying the time of exposure in hours by the calculated HSI value will give a more accurate evaluation of the overall exposure, particularly in instances where the time of exposure may be of short duration or intermittent.

Foundry Heat Problem

A medium sized shell mold foundry has three parallel pouring

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**Mr. Lemke is a graduate mechanical engineer and a member of the American Conference of Governmental Industrial Hygienists.*

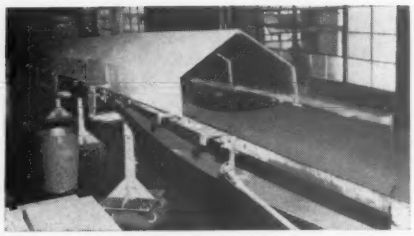

Fig. 1: Aluminum baffle enclosure covers this conveyor, minimizing heat loss from glass part and protecting workers from heat.

(Continued from preceding page)

lines equipped with back-draft hoods to remove the pouring fumes and the dust generated from the knockout operation. The hoods are 55 ft. long and separated by a distance of 10 ft. Men are required to work between the hoods to perform the following hot operations:

1. *Placement of shell molds on rack beneath the hood.*
2. *Pouring steel into the shell molds.*
3. *Knocking the hot casting free from the shell, after the metal has solidified.*
4. *Hooking out, or removing the hot castings from the pouring line.*

On the basis of Table 2 (Page 26, July issue), the HSI value of 125 indicates a condition of stress. The worker is not able to dissipate sufficient heat by evaporation to cool himself and maintain body heat balance.

Heat Reduction

In the preceding problem, radiation accounts for 40 percent of the total heat load, and convective heat only amounts to 4.6 percent of the total.

Radiant shielding with sheet aluminum is low in cost and will afford approximately 63 percent reduction in the radiant heat load, thereby reducing radiant heat (R) from 871 Btu per hour to 322 Btu per hour. In turn, the required evaporation and HSI will both be lowered.

Fresh outside air delivered to the work station at high velocities (600 fpm) will have a twofold effect, by decreasing the heat gained from convection and by increasing the worker's maximum evaporative capacity. For use in this problem, the outside air temperatures are 72°F wet bulb and 90°F dry bulb, with the air being delivered at a velocity of 600 fpm.

HEAT STRESS EVALUATION

MEASUREMENTS—Made at work station (K) during knockout operation.

t_g = 131°F	globe temperature	(black globe thermometer)
t_a = 100°F	dry bulb temperature	(shielded dry bulb thermometer)
t_{wb} = 75°F	wet bulb temperature	(shielded wet bulb thermometer)
V = 100 fpm	air velocity	(velometer or anemometer)

R (Radiant Heat)

$R = 22 (t_w - t_s) \times 0.6$
$= 22 (161 - 95) \times 0.6$
$= 871$ Btuh

C (Convective Heat)

$C = 2\sqrt{V} (t_a - t_s)$
$= 2 \times 10 (100 - 95)$
$= 100$ Btuh

M (Metabolic Heat)

$M = 1200$ Btuh

t_s = body skin temperature (use 95°F)

t_w = mean radiant temperature. (t_w can be determined by using step charts Figure 7 or by formula)

$$t_w = \sqrt[4]{T_g^4 + 0.103 \times 10^9 \sqrt{V} (t_g - t_a)}$$

T_g = absolute globe temperature

0.6 is a factor applied to radiant heat equation for fully clothed worker. Use 1.0 for semi-nude (no shirt) worker

P_a = water vapor pressure in air mm. of Hg. (obtained from psychrometric chart)

P_s = (42) denotes water vapor pressure at skin surface

M (values for metabolic heat listed on Table #1)

E_{req} evaporative heat loss REQUIRED to maintain body heat balance

$E_{req} = M \pm C \pm R$
$= 1200 + 100 + 871$
$= 2171$ Btuh

E_{max} MAXIMUM possible evaporative heat loss in working environment

$E_{max} = 10.3 \times V^{0.4} \times (42 - P_a)$
$= 10.3 (100^{0.4}) (42 - 15.3)$
$= 1733$ Btuh

H.S.I. (HEAT STRESS INDEX)

$$HSI = \frac{E_{req}}{E_{max}} \times 100$$
$$= \frac{2171}{1733} \times 100$$
$$= \boxed{125}$$

H_a (MAXIMUM EXPOSURE HOURS

$$H_a = \frac{250}{E_{req} - E_{max}}$$
$$= \frac{250}{2171 - 1733}$$
$= 0.57$ hours

This heat stress evaluation table refers to the foundry heat problem which begins at the bottom of page 27.

t_a = 90F.
t_{wb} = 72°F.
V = 600 fpm.
$C = 2\sqrt{600} (90 - 95) = -246$ Btuh
$E_{max} = 10.3 \times V^{0.4} \times (42 - P_a)$
$= 10.3 \times 600^{0.4} \times (42 - 15.2)$
$= 3560$ Btuh.

Heat is no longer gained by convection as indicated by the minus sign. It is now lost at a rate of 246 Btuh.

E_{max} is also increased by using outside air from 1733 Btuh to 3560 Btuh.

Table 3 is a comparison of the effect various control measures will have at workstation (K).

In other heat problems, conditions will differ depending on the source of heat. Generally, in most instances where a severe condition exists, there is a radiant heat source which can be controlled with reflective shielding. The engineer will find that it pays dividends to analyze his entire problem and pre-determine the effect various control measures will have rather

than applying controls in a haphazard fashion.

Control of Heat

When, through calculations or complaints, heat problems become apparent, control measures in the form of shielding and/or ventilation are usually indicated.

Shielding Techniques

Radiant heat energy is the most common source of heat encountered in severe stress conditions. As a form of wave motion similar to light and radio, it is unaffected by air motion. Pedestal or man-cooler fans don't help a bit. Radiant heat waves are emitted from hot surfaces, open flames, and flowing metal. This type of heat is common to industries with very hot processes, such as foundries and glass making plants. Radiant waves travel in straight lines and can be absorbed or reflected, depending on the characteristic of the material that they strike.

It is this ability to be reflected that allows for an inexpensive method of control. Shiny metal surfaces make good reflectors of radiant heat. Corrugated or flat sheet aluminum are excellent reflectors and corrugated sheet, being rigid, is easy to install. Since thickness of the material has no bearing on its reflective ability, very light sheets and foil can be used. Flexible reflective curtains are also available and have been used with success as shields for the front of oven openings where rigid shields would block a continuous flow of materials to the operation.

A relatively new shielding material is infrared reflecting glass. This material can be used for radiant shielding at locations where it is necessary that the worker observe the operation.

Basic rules to be observed when providing reflective shielding are:

1. Place shield directly between the source of radiant heat and the area to be protected. Radiant heat travels in straight lines and will thus be reflected back to the source.

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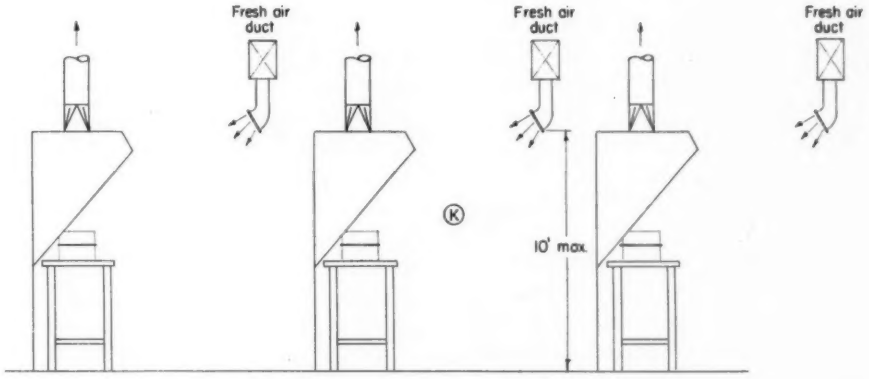
Fig. 2: Right, refers to foundry heat problem beginning on page 27. Note location K referred to in text on this problem, page 27.

TABLE 3

	Initial Conditions (Btuh)	Radiant Shielding (Btuh)	Air Supply (Btuh)	Shielding and Outside Air Supply (Btuh)
M	1200	1200	1200	1200
R	871	322	871	322
C	100	100	–246	–246
E_{req}	2171	1622	1825	1276
E_{max}	1733	1733	2400*	2400*
HSI	125	94	76	53

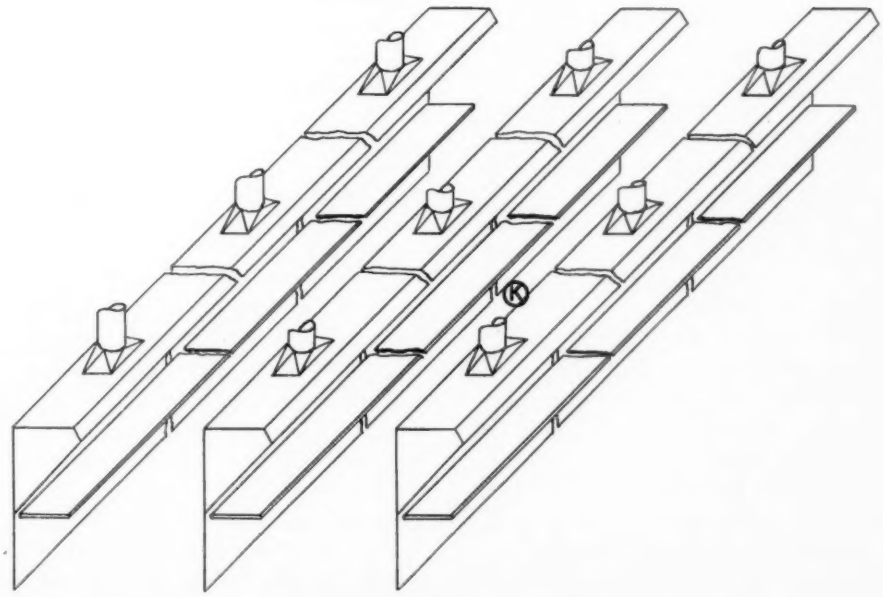
**Calculated E_{max} = 3560 Btuh. 2400 Btuh rate is used because of limitation imposed by body sweating capacity.*

Above: Table 3 compares the effect various control measures will have at work station K in Figs. 2 and 3, as shown in text on foundry problem beginning at bottom of page 27.



Outside air introduced at each work station from the 10' level.

Fig. 3: Above, outside air delivered to work stations at velocities of about 600 fpm at a temperature no greater than 72°F wet bulb and 90°F dry bulb, will aid materially in man cooling.



Shell molding pouring lines 55' long.

An engineer's look at . . .

Negative Air Ions

Because high altitude radiation belts build up negative air ions in space ships, and because air ions are generated inside long-submerged nuclear subs, a spate of research on these air ions has been done recently. Here is a summary of the latest data on effects of air ions of both polarities, on health, emotional well being and general alertness.

by L. A. Staebler,
Manager, Advanced Development, and
F. P. Speicher, *Biologist,*
Philco Corporation

WHY ARE AIR IONS important to man's environment? What are the physiological mechanisms, the psychological effects?

These are among the questions which climatologists, physicists, psychologists, and physicians are seeking to answer in clinical investigation of air ionization. The search for answers began at the dawn of the twentieth century when ions and sizes were firmly established.

With ion counters, researchers measured ion levels wherever possible—cities, country, opera houses, mountain areas, at sea, at resorts. They concluded that positive ions were found to predominate in most places but where there were a predominate number of negative ions, these areas were generally known as places men seek out for purposes of health or relaxation.

By the thirties, many researchers concluded that negative ions were beneficial to man's health. The research moved from the outside to the inside of laboratories. Instead of depending on nature's erratic supply of ions, the researcher began making artificial ions which he found could be generated with high voltage discharges, radioactive materials or incandescent materials.

As in many areas of research, the initial efforts were slow, handicapped by lack of funds and the general disinterest toward the hypotheses which formed the basis of the work.

Nature creates ions through radiant energy and radioactive bombardment in space and on the earth's surface, showering to earth a constant stream of both positive and negative ions.

As a part of man's environment, this shower of ions varies in density, in size and in polarity. Altitude and weather are major factors, but even more important to ion variations is the environmental conditions man himself produces and under which he lives.

Air Pollution Effects

As examples, the mobility of ions are affected by air contaminants. Industrial atmospheres and urban conditions induce concentrations of slow moving, large ions and diminish the quantities of small and intermediate size ions.

The interiors of homes and buildings act as a shield against ion penetration to reduce the levels; greater reductions occur when people collect in enclosed places. And with all the comforts of heating and air conditioning, the polarity balances of ions are further upset by absorption in ductwork or the unintentional overproduction of ions of a single polarity by electro-mechanical and thermal equipment man uses.

Research has definitely established that air ionization does have a direct affect on life in the forms as we know it. Certain microorganisms, for example, are accelerated in growth under sub-optimum conditions when exposed to heavy concentrations of negative ions, and slightly retarded under those conditions when exposed to positive ionization.

The cilia that line the trachea of animals (and humans) moves at a considerably faster beat and mucus flow is increased when exposed to negative air ionizations. Positive ionization reduces the beat and the mucus flow.

Two other physiological mechanisms of air ionization are theorized in respect to negative ionization. Under inhalation of negative ions into the lungs, a reflex mechanism stimulates the organism as the pulmonary receptors respond and send impulses to the central nervous system and its high departments. Also a humoral mechanism affects the organism which is functioning other than normal appears to respond with a "normalizing" effect.

At the normal levels of negative air ionization, therapy (1000 or more negative ions per cc) evidence already exists that negative ions are beneficial in the treatment

Above: Philco ionizer maintains proper level of negative air ions in rooms of about 300 sq. ft. Ionizers for installation in central air handling systems haven't been developed yet, because of the capacity needed. 90-percent plus of negative ions from a centrally located unit would be neutralized by ductwork.

of airborne allergies. More than two-thirds of the patients suffering symptoms of hay fever (and hay fever and asthma) secure partial or complete relief from the symptoms during their exposure to negative ionization.

On the other hand, positive ionization induces hay fever symptoms in 60 percent of the cases where there is a history of the allergy.

Alleviates Burn Pain

A large proportion of patients treated for thermal burns by exposure to negative air ionization receive beneficial effects by an almost immediate reduction in severity or cessation of pain.

Treatment of burns by direct exposure of negative ionization influences healing. A drying effect in the area of the burn, a reduction in the loss of exudate, an accelerate growth of eschars, an elimination of burn odors, and a considerable reduction in local infections are reported. Also accompanying this treatment is a faster growth of new skin tissue.

Similarly, post-operative patients exposed to negative ionization appear to recover faster and with less pain.

Ionization also carries over to the field of psychology. In this area, it appears that man can recognize when his environment changes in respect to the polarity of ions which predominate. He recognizes this by "feeling" the differences in comfort. He "feels" more comfortable in a negatively ionized environment, and "feels" less comfortable in a positively ionized environment. These environments also affect his productivity to the extent that he works slightly better in accomplishing skills under a negative environment than under a positive environment.

Negative ionization equipment is already on the market. It is being used in hospitals for treatment of patients and in laboratories for continuing research. It is available to consumers—those who suffer from the discomforts of air-borne allergies—in portable units so that beneficial relief can be secured during the seasonal sieges of the allergic conditions. It is also available as a part of air conditioning units, affording beneficial relief to air-borne allergy sufferers.

Ionization equipment today is indeed a medical electronic achievement and accordingly should not be confused with the so called "air purifiers." The negative air ionizer has one specific job to do—enrich the air with negative ions to provide for hay fever and air-borne allergy sufferers. Its design and research are exclusively the result of proven clinical investigation and application. ▲▲

Note: For a list of manufacturers of negative ionizers, circle No. 205 on the addressed, postage-paid inquiry card on page 35.

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c. KRUEGER, A. P. and SMITH, R. F.: Effects of Gaseous Ions on Tracheal Ciliary Rate, *Society for Experimental Biology and Medicine; proceedings, 98, 412-414, 1958.*

Use the reply card on page 35 to comment on any article in this issue, or to ask for more information on products shown.

Techniques of

Low Level Air Distribution

Above: At Schick's shaver plant, recently air conditioned, air is delivered far below high bays, at the working level, to reduce costs, avoid stagnant air mix.

Costs of factory air conditioning can be materially reduced by introducing conditioned air below hot, stagnant layer of air near roof. Here's how it's done.

by C. F. Mowrey,
Consulting Engineer,
Cincinnati, Ohio

ALTHOUGH LOW LEVEL air distribution has been deemed advantageous for quite some time, it is receiving increasing attention with the increasing use of air conditioning in manufacturing areas.

First let us consider the advantages of low level air distribution for ventilation only. Consider a typical high bay factory with overhead air supply and exhaust. Assume a lighting intensity of 50-60 foot candles and a motor and process load of such proportions that if the area were air conditioned the design requirements would be based on an average of five tons per 1000 sq. ft. of floor area. Assume a ventilation capacity great enough to provide the equivalent of 30 air changes per hour at a 10 ft. ceiling level. Even at this high capacity the air change would be at the rate of only 5 cfm/sq. ft. of floor area.

If this air were rising evenly to be exhausted at the ceiling, the rate of travel would be only 5 fpm, one-tenth of what is commonly regarded as the threshold of a draft. All of this shows that even with high ventilating capacity there lies under the roof a semi-stagnant layer of hot air.

If the supply air were to be distributed at a level of say 9 or 10 ft. above floor level (below the general lighting system), the blowing of a large amount of warm air to the lower level would be eliminated.

Next we will consider the resulting effects of low level air distribution if air conditioning were to be included.

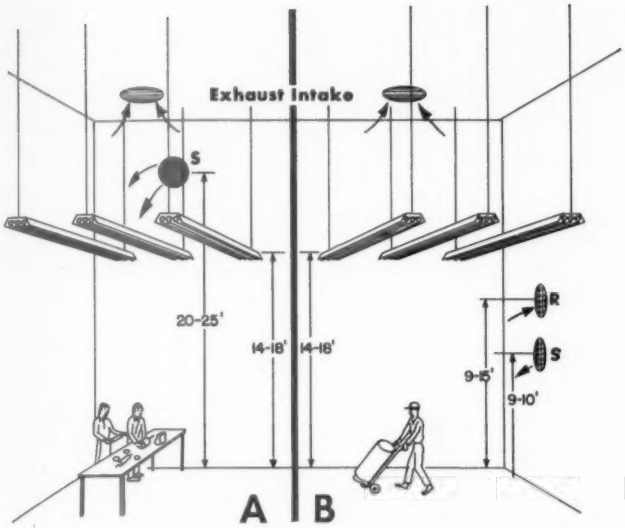
The previous reference to an air conditioning load of 5 tons per 1000 sq. ft. of floor area of course assumed a normal amount of make-up air of say 25 percent. At an air flow of mixed recirculating and make-up air of 400 cfm per ton, the make-up air would amount to 100 cfm per ton or 500 cfm per 1000 sq. ft. of floor area.

Incidentally, although this amount of outside air is a reasonable example it is only 10-percent of the amount assumed for ventilation in the above example when air conditioning was not involved.

On a cut and try basis assume that low level air distribution would reduce the peak capacity requirement 20 percent or one ton per 1000 sq. ft. Assume further that all of this gain would be accounted for in the increased temperature of the exhaust air through the roof at 500 cfm per 1000 sq. ft.

The maximum consequent temperature rise above the exhaust temperature that would have prevailed at high level air distribution would be approximately 22°. Expressed in another manner the mixture of outside air and recirculated air before passing through the cooling coils would be at a temperature of approximately 5.5° lower than the temperature that would have prevailed at high level distribution.

Let us take a look to see if enough of this heat would be readily available at high level to raise the temperature 22°. The heat available above the lighting fixtures would come principally from the lighting and the external heat load on the roof and upper walls. The electric heat equivalent necessary to provide general lighting consistent with the above total air conditioning requirements would be approximately 9000 Btu per 1000 sq. ft. The type of roof fitting the general picture (1½ in. of insulation) would result in a heat gain of about 9000 Btu/1000 sq. ft.



Above: Drawing shows methods of introducing air at low levels. Idea is to avoid having cooled air mix with hot, stagnant layer of air at ceiling height.

About 75 percent of the heat from the fluorescent lighting would be directed upwards by radiation and convection. This, with the roof load, would constitute a total of 16,750 Btu above the level of the lighting fixtures. Inasmuch as there were required only 12,000 Btu to meet the assumed conditions of reducing the heat gain 20 percent, there remains plenty of leadway to allow for some interchange of air.

It would be advisable to determine if at peak conditions the radiation effect from the under side of the roof might be significantly increased by the increase in temperature of the exhaust air.

The overall effect would depend upon the amount of roof insulation, the color of the underside, the type of floor, percent of floor area covered by products, the amount of ventilation air, etc. With fairly clean aluminum paint on the underside of the roof the inner radiation effect would be negligible under all practical circumstances. Where the floor is concrete on the ground, a considerable amount of added radiation at peak loads would be absorbed into the ground in many cases, and in some part would be radiated back to the roof and finally to outer space from the outer roof surface. This "reverse radiation" would depend particularly upon the type of roofing and the difference between day and night temperatures. It is to be noted that a roof can radiate heat to outer space when the surface is cooler than the surrounding air.*

As indicated in the foregoing, low level air distribution for high bay areas is well worth investigation for two reasons. It can often postpone the necessity of air conditioning, and when air conditioning is finally added, low level supply with simple low level returns can materially reduce the required capacity and operating costs. ▲▲

*"Periodic Heat Flow Thru Flat Roofs," by D. J. Vild, M. L. Erickson, G. V. Parmelee, A. N. Cermy, *Transactions ASHVE Vol. 61, 1955.*

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[For more information circle #23 on page 35]

New Literature

To receive information on any of the New Literature listed on the following pages, circle the item reference number on the postage-free reply cards on page 35, Communications Center.

Electrostatic Precipitators

New 12-page illustrated bulletin describing the new line of American-Standard electrostatic precipitators is now available from American-Standard Industrial Division.

Circle #139 on page 35.

Compact Centrifugal Roof Ventilator

Engineering data certified by AMCA, full performance and construction specifications are contained in a bulletin on the "Centridyne" centrifugal roof ventilator from Western Engineering & Mfg. Co.

Circle #140 on page 35.

Vacuum Heating Pumps

Domestic Pump and Manufacturing Corp. has published a bulletin describing their line of individually sized and separately controlled vacuum and condensate pumps.

Circle #141 on page 35.

Air Purification With Activated Charcoal

Released by Barnebey-Cheney describing their line of products utilizing activated charcoal filters.

Circle #142 on page 35.

Bulletin Describing Aftercooler

Eight-page bulletin describing "Paracoil" Type AC Aftercoolers for compressed air and gas applications from Davis Engineering Division of Tube Reducing Corp.

Circle #143 on page 35.

Centralized Lubrication Equipment

New 32-page catalog illustrating and describing Lincoln Engineering Co. complete line of lubricant application equipment.

Circle #144 on page 35.

Testing Instruments Catalog

Gardner Laboratory Inc., designers and makers of testing instruments for paint, paper, plastics, ceramics, food, and other materials, has issued a new catalog listing their optical as well as physical test instruments.

Circle #145 on page 35.

Oil Separator

Peabody Engineering Corporation announces literature (Form 25-013) on new Peabody Scrubber-Cooler for oil mist removal. Unit is said to have collecting efficiency of 99.9 percent by weight. For use wherever oil mist is a problem, as on compressed air, machinery, etc.

Circle #146 on page 35.

Wet Scrubbers

According to Air Pollution Control Systems, Inc. in a brochure on the H&M Wet Scrubber, the low cost solution to air pollution problems.

Circle #147 on page 35.

Standard For Unitary Heat Pump Equipment

From the Air-Conditioning and Refrigeration Institute a revised Standard for Unitary Heat Pump Equipment has just been published.

Circle #148 on page 35.

Vacuum Probe

For picking up tiny parts in White Rooms, new Bazooka Vacuum Probe and Transducer is detailed in bulletin issued by Air-Vac Engineering Co., Inc. Probes hold, sort and carry tiny intricate parts by means of vacuum supplied by transducer. Permits operators to handle delicate parts faster, more accurately. Said to end rejects due to scratching, marring, nicking of finished parts.

Circle #149 on page 35.

Low Silhouette Exhausters

For use as centrifugal room exhauster, or with a propeller blade, new line of Linea exhausters by Penn Ventilator Co. is described in Bulletin L-61. Includes complete engineering data.

Circle #150 on page 35.

Cabinet Type Dust Collectors

Two page brochure gives all details on Vacculator Co., Inc. cabinet-type dust collectors for which high efficiency is claimed. Three models give about 400, 600 and 900 cfm capacities. Each unit has two electrostatic filters in series.

Circle #151 on page 35.

Hydrocarbon Analyzers

Two new instruments that detect and measure trace concentrations of hydrocarbons in gases, vapors or atmosphere are described in Beckman Instruments' Bulletin GA-4029. Instruments operate on principle of hydrogen flame ionization of carbon atoms, provides sensitivity of 0-4 parts per million carbon full scale.

Circle #152 on page 35.

Fan-Coil Motor Valve

Erie Manufacturing Co. has published a bulletin on their new motor valves for fan-coil units and similar applications. Cost is said to be comparable to solenoid valves used for these purposes. The new motor valves use a motor and valve disk member, have three-way operation and two-way operation, depending on model. For ⅝ in. o.d. tubing, max. 200°F, 125 psi.

Circle #153 on page 35.

(Please turn to page 36)

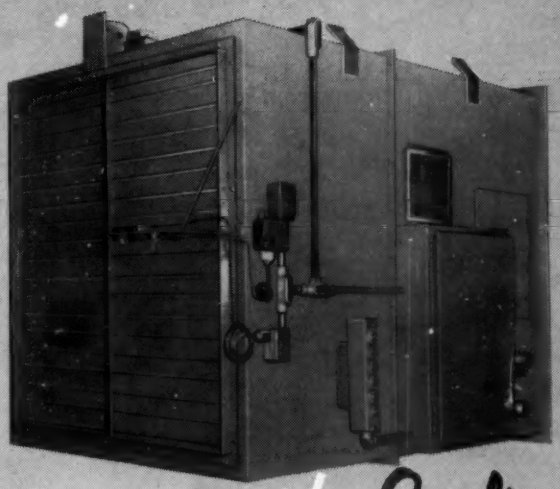
Precipitators Remove 99% Fly Ash At Con Ed

Electrical precipitators for the new 350,000-kw generating station recently completed by Con Edison at Arthur Kill, Staten Island are guaranteed 99 percent efficient in removing fly ash from boiler combustion gases. The Cottrell precipitators at the base of a 500-foot stack were designed and built by Research-Cottrell, Inc., Bound Brook, N. J. Two combined mechanical-electrical precipitators for the unit's single pulverized coal fired boiler handle 1,400,000 cubic feet per minute of combustion gases, at a temperature of 300°F. Cottrell design features which enable these combination precipitators to maintain the required high efficiency include Cyclo-trell mechanical collectors, multi-electrical sectionalization (separate rectifier-transformer sets for energizing each of the many sections of the precipitators) and continuous, automatic operation of high tension rappers and M.I. plate rappers. In addition, Research-Cottrell used 3-dimensional gas flow model studies in designing the inlet and outlet flues for this installation.

Use Communications Center, page 35, for requesting information about advertised products, new literature, or new products.

two of a kind...

for all in-plant requirements

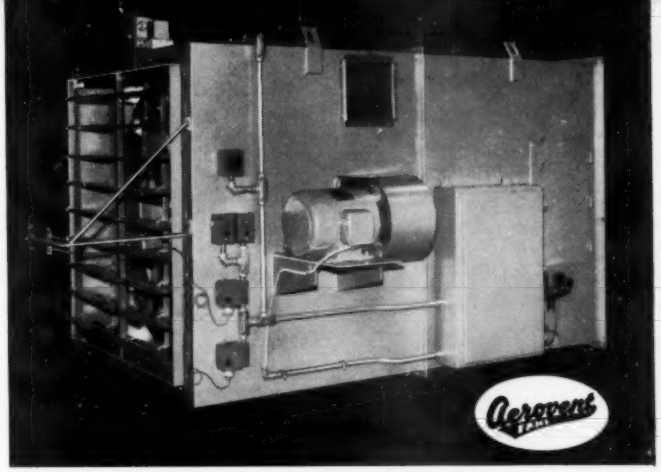


direct-connected

Gas-fired

belt-driven

air make-up units



Let the breezes blow! You can maintain uniform temperatures and derive maximum efficiency from heating and ventilating systems *this* winter with Aerovent Gas-Fired Air Make-Up Units. And, you will be ready for next summer's heat, too, since each unit also serves as a filtered air supply unit. Why not investigate, today?

Standard models for all structures and all requirements in sizes 27" through 60" for capacities to 50,000 CFM and BTU/hr ratings to 4,875,000. Other units to specifications for capacities to 100,000 CFM and heat releases to 10,000,000 BTU/hr. Write for details and application data included with new Bulletin 860.

Air deliveries of all Aerovent equipment are tested and rated in accordance with established and accepted codes and each unit is guaranteed by the manufacturer to deliver its rated performance.

CERTIFIED PERFORMANCE

Aerovent FAN COMPANY, INC.

ASH and BRIAN STS. PIQUA, OHIO

[For more information circle #27 on page 35]

New PRODUCTS

To receive information on any of the New Products, circle the item reference number on the postage-free reply cards on page 35, Communications Center.

New Hopper Design

Purpose: For dust collection units.

Features: Designed to eliminate build-up and bridging of filtered materials at the outlet point of the hopper, as well as clogging and jamming of the dump slide, the new Aget Manufacturing Co. hopper incorporates a cam action gate. This radical design is said to provide a terrific force which breaks the gate loose under practically any conditions, and also embodies a receding and sliding action of the gate itself which facilities the dumping action. A wedging effect in the guides and supports of the slide guarantee a positive seal, regardless of wear. The cam action gate has a dump opening of 12 in. x 24 in., which greatly speeds up the dumping cycle.

Circle #71 on page 35.

New Package Combustion System

Purpose: Convert any commercial, industrial high or low pressure boiler, large oven or dryer to fully automatic operation, using fuel oil, gas or oil and gas.

Features: Forced Draft Thermopak, developed by Preferred Utilities Manufacturing Corp., can be used where natural draft is inadequate or induced draft unavailable; may be applied to any firebox where pressure does not exceed ¾ in. w.c. at maximum firing rate.

Burner accessories, fan and motor, and control cabinet are all mounted on extension front, without need for obstructive front supporting structure. Access to boiler doors and cleanout areas is unobstructed. Field wiring is reduced to but a few connections. Oil supply requires only two simple connections, and gas piping one.

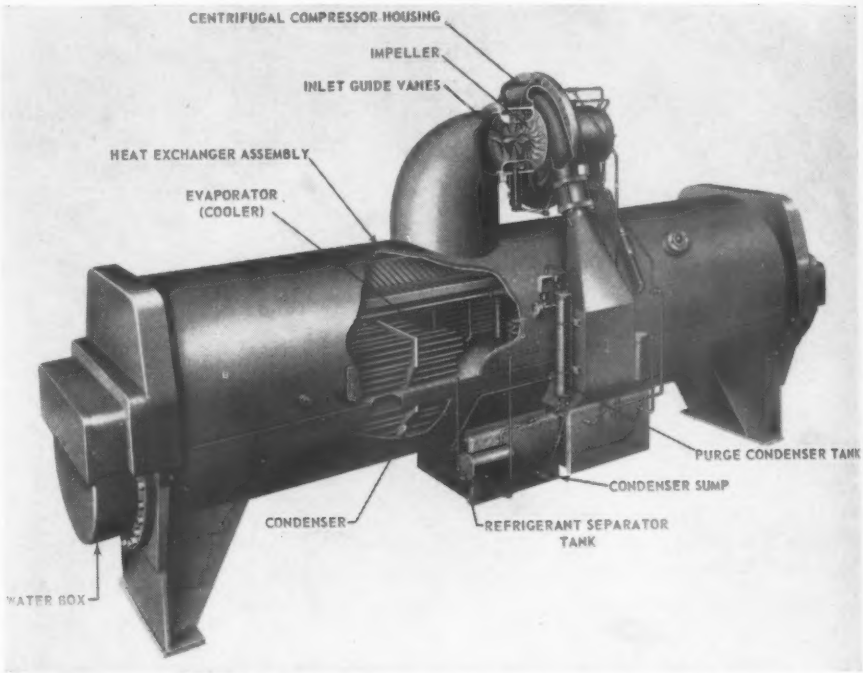
A highly efficient inset multiblade fan supplies all secondary air for combustion, and a shutter-type primary air and a vortex secondary air metering device insures proper regulation and straight line metering of fuel to obtain smokeless, quiet, constant high combustion efficiency.

The refractory construction consists of 60 percent alumina diaspore fire clay brick, non-shrinking and spall-resistant, superior to preformed refractory tile construction.

The flame is sustained in the unit's factory installed combustion chamber, without depending on massive internal boiler refractory.

The unit is available with 4 different models of Preferred horizontal rotary oil burners, a nozzle mix type gas burner or a combination oil-gas burner in 10 sizes with maximum capacity from 15 to 175 gph for oil and 2200 to 25,500 cfh for 1050 Btu gas. All burners carry approval of Underwriters' Laboratories, Inc.

Circle #72 on page 35.



Centrifugal Tonrac compressor design by American Standard.

18,000 RPM Centrifugal Water Chiller

Purpose: Comfort and process air conditioning.

Features: Radical new centrifugal Tonrac compressor design by Industrial Division of American Standard comes in eight sizes from 50 to 100 tons capacity.

Using R-11 refrigerant, the compressor rotor is driven by an 18,000 rpm motor on 480 v, 3-phase, 300 cycle current. A separate motor-generator-exciter, which can be installed up to about 160 ft. from the unit itself, furnishes power to the compressor motor. Power unit can be driven by electric motor, steam or natural gas engine, offering a variety of power sources for operating as well as stand-by use.

Motor bearings of compressor drive, as well as the motor windings, are cooled by the refrigerant, so no separate oil cooler is required. Purger is compressorless, compact and integral.

Unit is fully assembled, insulated and wired, comes with all controls ready for piping to chilled water and condenser water lines.

Compact design saves up to three times the floor space and up to about 50 percent of the weight of similar equipment, according to the manufacturer. 100-ton Tonrac weighs 6700 lbs.

All eight sizes will fit through a standard 36-in. door.

Circle #73 on page 35.

Ultrasonic Parts Cleaner

Purpose: One-step batch cleaning of transistors, printed circuitry, instruments, machined parts and lenses.

Features: Vatronic 120 ultrasonic cleaner cleans in pure solvent vapors with simultaneous flushing action of pure solvent condensate that gently rains down on the work from the lid condenser.

Manufacturer claims carry-out of contaminates on the work is eliminated, because cleaning is done in the unit so work never comes in contact with contaminated solvent. Flushing and rinsing of work with pure solvent can be continued as long as desired.

Cleaner uses solvent such as Freon TF. Interior is of stainless steel.

Circle #74 on page 35.

Steam Humidification Unit

Purpose: According to the Bahnson Co., the unit provides simplicity and economy of installation and operation with high evaporative capacity.

Features: Steamette discharges steam vapor in a 360° radial pattern, or portions may be blanked off as desired. Installation is made by connection to existing steam supply lines and electrical outlets. Unit uses atmospheric drain line rather than condensate return line to the boiler, therefore eliminating steam traps.

Design permits re-evaporation of steam condensate in the unit during operating cycle. Drain line is required to remove excess line condensate on start-up.

Unit operates on steam pressures from 2 to 30 psig and 115 volt electric current.

Circle #75 on page 35.

Paint Arrestor Filter

Purpose: For spray booths.

Features: American Air Filter Company's new glass-fiber paint arrestor pad is said to give lower resistance to air flow with higher absorption qualities.

According to the manufacturer, one 2-in. AG Pad does the work of two 1-in. pads now commonly used and provides a simplified and more effective method of arresting paint spray than paper-type pads.

AG Pads are engineered for spray booth field, with fiber glass filaments becoming progressively denser from air entering side to back of pad. Graded density resists 'face loading' and provides greater efficiency and longer service.

Because AG Pads, which are green on the air leaving side and white on the other side, are nonclogging and permit free air flow, there is less 'drag' on exhaust fans. Maintenance problems are reduced due to greater holding capacity of pads. Fans, motors, ducts stay cleaner because less paint spray gets through pads, more is caught and absorbed by the AG Pads. Paint spray sinks into pads with less splatter and 'bounce back,' resulting in cleaner spray booths. An entire bank of AG Pads can be changed in a matter of minutes, one-half the time required for paper-type pads.

(Please turn to following page)

WESTERN

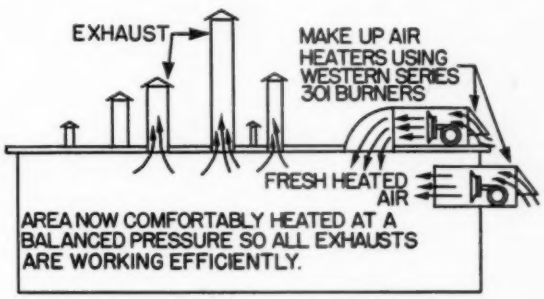
for

DIRECT GAS FIRED AIR MAKE UP

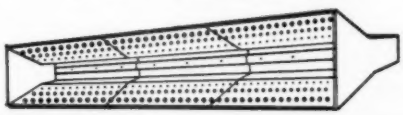
Series 301 AIR MAKE-UP BURNER

For improved working conditions and increased production in work areas where process requires heavy exhausting.

LOWER INITIAL COST
LOWER OPERATING COST
. . . NO HEAT EXCHANGER
. . . NO FLUE LOSSES


EXHAUST
MAKE UP AIR HEATERS USING WESTERN SERIES 301 BURNERS
FRESH HEATED AIR
AREA NOW COMFORTABLY HEATED AT A BALANCED PRESSURE SO ALL EXHAUSTS ARE WORKING EFFICIENTLY.

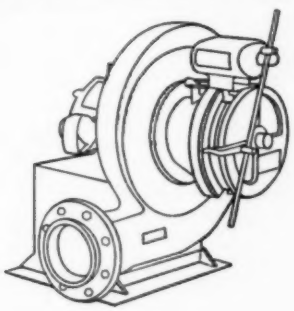
ODOR FREE COMBUSTION
30 to 1 TURNDOWN



390,000 Btu/hr Max. -13,000 Btu/hr Min. per lineal foot with 2000 FPM fresh air over the burner.

Excellent cross ignition at all firing rates. Designed for long burner life. Easy to clean and maintain.

Series 301 burner can be furnished in any configuration required.



Series 301 Motor-Mixer requires low H.P. and is quiet in operation.

Fabricated aluminum impeller. Heavy gauge steel case and base.

Patented Series 301 proportioning valve to accurately control the firing rate.

WESTERN

industrial combustion equipment

New Castle, Indiana

[For more information circle #24 on page 35]

New PRODUCTS

AG Pads are available in three standard sizes—20 x 20, 20 x 25, 16 x 25.

Circle #76 on page 35.

Portable Gas Scrubber

Purpose: For pilot plant use or cleaning gas from lab hoods.

Features: Schutte and Koerting packaged, portable gas cleaner combines an ejector-venturi gas scrubber with an inertial-impact type separator in one integral part. Liquid carryover is said to be reduced to 0.00002 gal/100 cfm.

Includes storage facilities for up to 150 gal. of water or caustic solution, pump, blower, piping, stack, Rotameter, motor combination starter-disconnects and removable mist eliminator.

Circle #77 on page 35.

Micronic Filtration

Purpose: Pacific Sintered Metals Co. has developed PORO-PAC filters to remove contaminants to 5 microns from all liquids and gases.

Features: The PORO-PAC features corrosion resistant brass cases, porous metal sintered bronze, ductile shockproof elements, that are easily cleaned and operate at temperatures of -400° F to +900° F.

All cases are rated at 250 psi and are completely sealed with "O" rings.

Circle #78 on page 35.

Central Station Packaged Air Conditioners

Purpose: From U. S. Air Conditioning Corp., for comfort cooling in industrial and commercial applications.

Features: Dual circuit semi-hermetic compressors which operate individually or together automatically for full capacity. Horizontally split evaporator coil, effective where lead variations require 50 percent capacity control or where dehumidification is needed at reduced operating capacity.

Optional built-in modulating head pressure control. Unit can be furnished in two sections for remote condenser location.

Capacities of 30 to 60 ton.

Circle #79 on page 35.

Industrial Centrifugal Fan

Purpose: Series of heavy-duty industrial fans with airfoil blading for applications in: combustion air for steel mill and industrial furnaces; packaged steam boilers; and for industrial processes as glass cooling, vacuum drying, and exhaust from aluminum pot lines. Manufactured by Westinghouse Electric Corp.

Features: Capacities from 15,000 to 450,000 cfm, units are available in five a-c direct-connected motor speeds: 1800, 1500, 1200, 900 and 750 rpm. Within this range are included ten sizes of AMCA Class III-type fans with wheels from 30 to 81 in. in diameter; and fourteen sizes of AMCA Class IV-type fans with wheel diameters from 30 to 109 in. The fans can handle air from -20° to 800°F.

Built of heavy steel construction, welded and reinforced throughout to prevent vibration.

Circle #80 on page 35.

Water Resistant Sub-micron Filter

Purpose: To add to service life of sub-micron type filters where moisture is a problem.

Features: Mine Safety Appliances Co. announces that their Ultra-Aire filter elements now have increased moisture resistance because a permanent water repellent has been added to the basic glass-micro-filter filter medium in the manufacturing process. Filters are resistant to high moisture concentrations, are said to afford high efficiency filtration of water particles without excessive pressure

CLASS "A" WHITE ROOM?

If your walls and ceilings aren't permanently clean—nothing is! Here is the way to achieve economical, quick, easy enclosure—really clean!

USE PORCELAIN ENAMEL FACED BUILDING PANELS BY MIRAWAL

- No retention of dust
- No "chalking" or flaking
- Glass hard, abrasion-resistant surface
- Ten-year warranty
- Highest impact resistance of any vitreous porcelain on steel
- Many installations in "white rooms" giving complete satisfaction
- Low cost simple maintenance
- Acid resistant, chemically stable
- Static free
- Glare-proof flatness
- Experienced installers throughout U.S.
- Choice of standard, pastel, fade-proof colors (including pure white)

Write us for literature and name of nearest representative, plus color guide.

MIRAWAL
BIRDSBORO, PENNSYLVANIA

DIVISION OF BIRDSBORO CORPORATION
JUNIPER 2-2011 (AREA CODE 215)

[For more information circle #25 on page 35 reply cards]

drop or weakening of the filter medium.

Some models of the MSA filters resist temperatures to 800°F. They remove 99.7 percent of particles down to 0.3 micron dia.

Circle #81 on page 35.

Particle Size Analyser

Purpose: Union Industrial Equipment Corporation's Cascade Impactor particle analyser.

Features: Permits: particle size analyses can be performed by means of mass determinations . . . aerosol size distribution without background particles . . . size distribution of dusts which are altered by the process of collection, or which decay or decompose following collection.

Circle #82 on page 35.

15-Ton Heat Pump

Purpose: Heating and cooling for a wide range of climatic conditions and applications.

Features: Carrier Air Conditioning Company's new 15-ton nominal capacity heat pump produces 173,000 Btu of cooling at 95°F outdoor air temperature and 67°F indoor wet bulb. At 40°F outdoor air for 70°F indoors, it produces 162,000 Btu of heating. Up to three accessory electric heaters of 19.1 KW each may be mounted on the fan deck. Defrost cycle occurs every 60 minutes, when outdoor temperatures require it. Outdoor section can be located 60 ft. above or below indoor unit. Indoor unit can be used with or without ductwork, has matching plenum for free discharge. Without plenum and with fan section on top, indoor unit is 80 in. wide, 63½ in. high and 29¼ in. deep. With fan on back, it's 80 in. by 46 in. by 52 in. Can be mounted vertically, horizontally, ceiling suspended or floor mounted.

Circle #83 on page 35.

Air-Stream Burners With Wide Turndown Range

Purpose: Air-heating application, oven heating systems, etc.

Features: According to Eclipse Fuel Engineering, used in conjunction with variable ratio-type mixers, a turndown range of 25:1 is attainable with air make-up heating systems.

Recommended maximum air velocities are 3000 ft/min in air make-up systems and 3500 ft/min in oven heaters. Capacities available to 400,000 Btu/hr per 12 in. burner section.

Circle #84 on page 35.

Ceiling Ventilation System

Purpose: For air flow control from acoustical ceilings.

Features: The Vent-Spline, an extruded plastic member can be adjusted from within the room to provide air distribution patterns within the area. According to Elof Hansson, Inc., savings compared to other ventilating ceiling systems and conventional diffusers are obtained through the omission of duct work and diffusers.

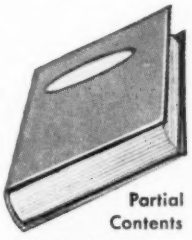
Circle #85 on page 35.

Outlining modern theory and practice for . . .

Efficient refrigeration and the cooling and dehumidifying of air

This book brings to readers a convenient reference on the basic theory and practices for the design and application of modern refrigeration and air conditioning equipment. The author puts special emphasis on the commercially-important vapor-compression cycle; however, more specialized types of refrigeration systems are also surveyed.

Principles of heat transfer are incorporated in the book to help in the analysis of the performance of actual refrigeration and air conditioning equipment. In addition, a unified treatment of heat- and mass-transfer explains the characteristics of heat-transfer devices for air conditioning.



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[For more information circle #26 on page 35]

Pneumatic Classifier

(Continued from page 19)

the curtain of feed material in the classifying zone without detrimental frictional effects of a solid wall.

It is by regulating secondary air supply that the cut point is varied.* Air is drawn through the inclined outlet duct at a constant rate, velocity of primary air will therefore vary as secondary air supply is varied. Velocity of primary air determines size of particle which will or will not make the turn into the inclined discharge duct, since it determines downward inertial force on the particle. To exit with fines, inertial force on a particle must be small enough to be overcome by drag force exerted on the particle as the air stream changes direction.

Fig. 3 shows one of the classifiers in the new Florida setup. Primary air for proper entrainment is supplied from the atmosphere through the vertical duct. Incoming material is delivered by the merging duct partially shown. The secondary air inlet extends downward and to the right. The damper which controls inlet air can be seen here.

Fig. 4: Rectangular duct which delivers coarse material from classifier into the bucket elevator system. Hopper toward center of picture receives fines from cyclones and discharges them into pneumatic conveyor equipment to their special storage facilities.

Fig. 5: In center, tops of cyclones which separate fines from the airstream exhausted from classifier. Ducts from cyclones carry cleaned gases to dryer exhaust ducts. Drive equipment on either side of cyclones is for screw conveyors which are located under the floor. Behind cyclones are compressor, air filter and compressor drive for pneumatic conveying system. In background is one of the dryers.

More than 8,000 pounds of material an hour is delivered to classifiers from dryer cyclones. About half of this is +100 mesh and half is –100 mesh. Separation is so complete that the coarse material contains only about 5-percent fines and the fines contain only about 6-percent coarse material. Further, the respective stray particles are very near the cut point size. Particles of exact cut point size can go either with the fines or coarse, and there is a small chance that particles especially close to the cut point size will be collected with the wrong element.

The new classifiers have no moving parts and consequently require almost no maintenance. They also require little in the way of power —merely fan motors at cyclones. No operator attention is needed once the classifier is set for given conditions.

Until the classifiers were installed at The American Agricultural Chemical Company, up to 4,000 pounds of dusty material—the fines—was discharged into the main storage bins every hour and much of this was lost. It is estimated that more than 95-percent of the formerly lost phosphates are now being reclaimed. ▲▲

Fig. 6: Spectacular results of the installation. Before classifying equipment was put in, material both larger and smaller than 100 mesh was dumped into these storage silos.

Cloud above bins was so thick it was impossible to distinguish bins except by shutting off supply conveyors long enough for partial settlement of dust. Not only have these billowing clouds vanished, but now, as the picture shows, there isn't even a haze. The supply conveyors, incidentally, are fed by the bucket elevators, which receive phosphates from the dryers.

**The "cut point" is the point differentiating between coarse and fine material. In this case it is 100 mesh. Particles smaller than 100 mesh are the "fines"; particles larger than 100 mesh make up the "coarse" material. The cut point is "100" or "100 mesh."*

EQUIPMENT CREDITS

Classifiers....Buell Engineering Co., Inc.
Pneumatic conveying system....The Fuller Co.
Cyclone collectors....Buell Engineering Co., Inc.

PVC alumina caustic soda sugar salt lime phosphate rock coal sodium hydrosulphite DDT sodium phosphate alumina soap particles metal ores aluminum oxide slag cement raw mix limestone sodium nitrate metal powders cosmetics sugar sodium phosphate DDT silicon carbide cocoa powder soda ash sodium hydrosulphite soap particles glass beads glass beads caustic soda cement raw mix slag lime aluminum oxide salt limestone cocoa powder coal PVC phosphate rock sodium nitrate cosmetics

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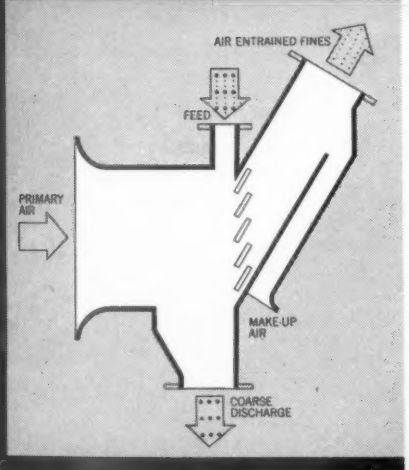
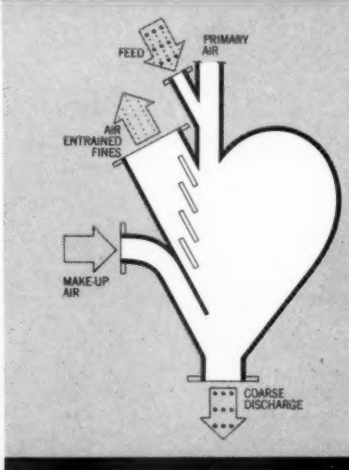
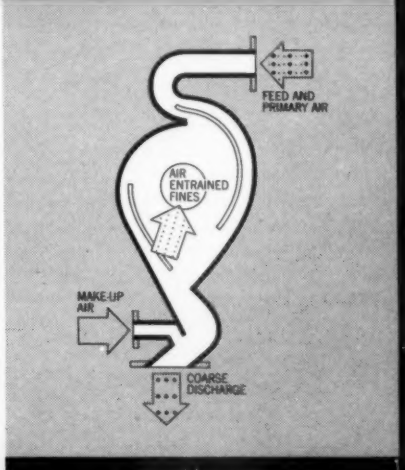


Gravitational Classifier — Replaces screens and sieves in the 20 to 65 mesh range with comparable or better efficiency. Low maintenance, instant control of cut point and limited space requirements.



Gravitational-Inertial Classifier — Extremely high efficiencies for separation in 65-200 mesh range. Pneumatic conveying and elevating of feed and fines, no moving parts, single damper to control cut points.



Centrifugal Classifier — Unmatched performance in the 200 mesh to 20 microns size range. No moving parts, easy adjustment of cut points, and pneumatic conveying and elevating of feed and fines.

Classifiers can be operated in series to obtain several closely sized fractions in one continuous operation.

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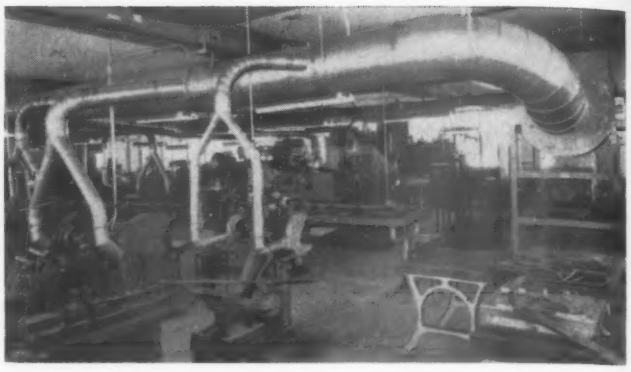

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(Continued from page 29)

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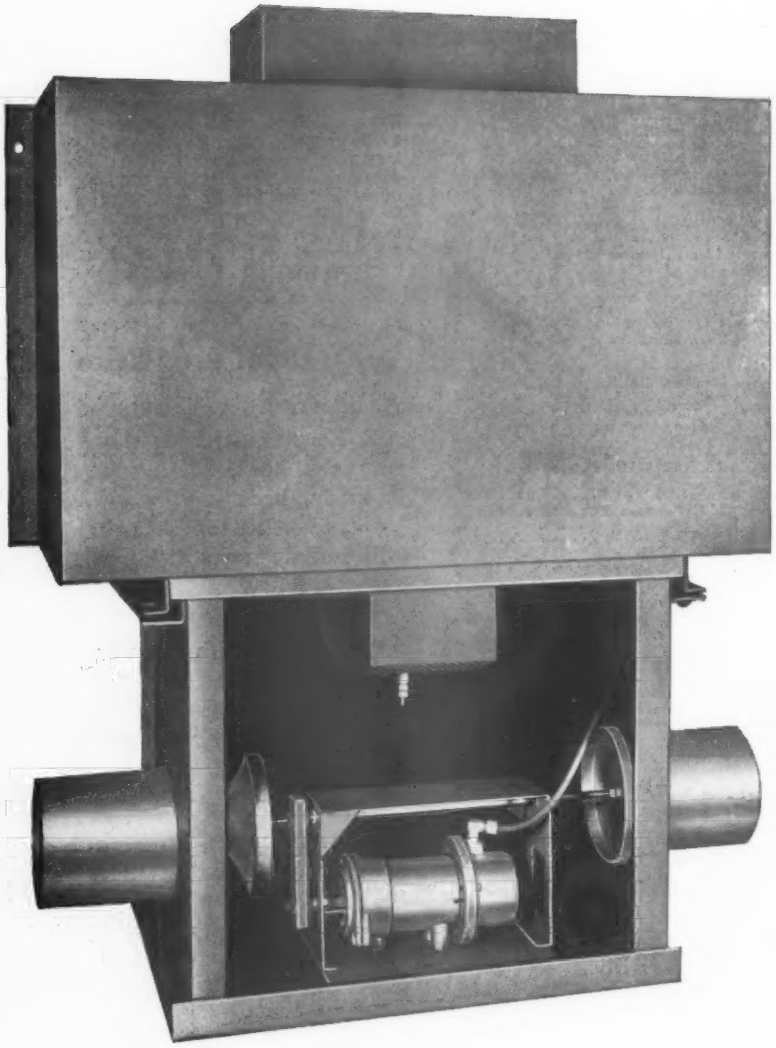

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